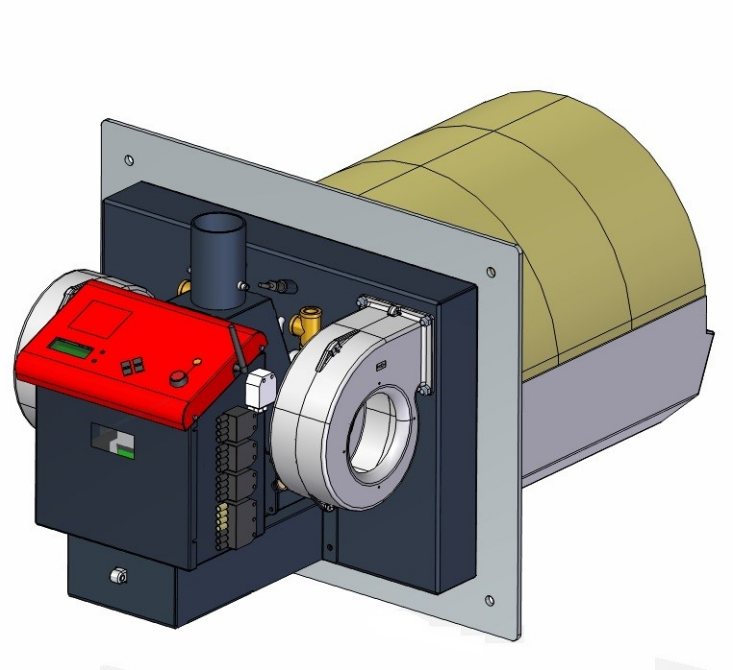

PV500 PELLET BURNER

DK9591A1

USER MANUAL

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Safety precautions

Do not start the burner before it is connected to the boiler and the boiler is connected to the chimney.

- It is recommended to wear a respirator while handling pellets.
- The boiler room where the burner is installed must fulfil all rules and recommendations given by authorities.
- All electrical connections must be done by trained professionals.
- No flammable materials must be stored near the burner.

Warnings

- Changing the construction of the burner without written permission from the manufacturer is forbidden.
- Use only spare parts provided or approved by the manufacturer in order to avoid any damage to the burner and dangers resulting from it
- Welding is allowed only after disconnecting the burner from electric supply. The circuit board must be removed from the burner.
- Do not open any boiler door while the burner is in operation.

Notice

- Manufacturer of burner has right to make changes in construction of burner and its firmware.

Burner corresponds to following directives and standards:

Directive 2004/108/EC
Directive 2006/95/EC
Directive 2001/95/EC
Directive 2006/42/EC
EN 15270 2008
EN 230 2005
EN 60370-2-5 2002

1 Set of components

Part	Quantity
Burner's housing	1
Burning chamber frame	1
Ceramic sealing	1
Sealing rope	1
Burning chamber bricks:	
Side bricks	6
Backside wall brick	2
Front bricks	2
Upper arc bricks	6
Grate ladder	1
Grate box	1
Burning chamber grates	4
Washer 13mm	6
Distance nut 14mm	6
M12x70 bolt	6
M12x45 bolt	6
M12x36 coupling nut	6
Sprinkler connector	1

Notice! Burner is delivered to client in fully put together.

2m polyurethan hose and 2 fixating brackets are separately in set.

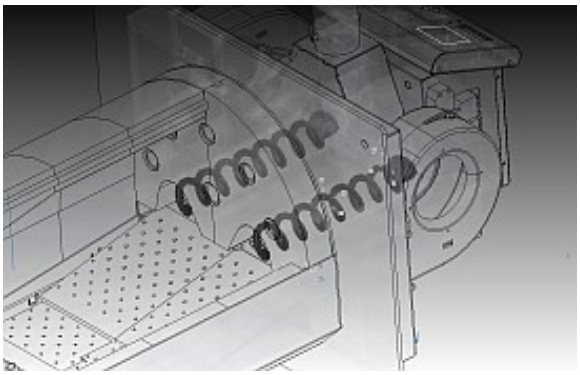
2 General description

PV500 is a burner of wooden pellets (sawdust granules) that is intended for heating of the industrial, agricultural and public buildings. Only wooden pellets with diameter 6 or 8mm can be used to run this burner. You cannot use any other form of fuel. Unique design of the burning chamber allows using industrial pellets run the burner. The construction allows burner to be used with different boilers: liquid fuel, solid fuel and universal boilers. The burner is connected to the boiler by using a connection plate.
The burner is equipped with a safety thermostat, a melting hose, temperature sensor, sprinkler system with pressure switch and auxiliary battery for protection against back-burning. Main technical data are given in Table 1.

Table 1 Technical data

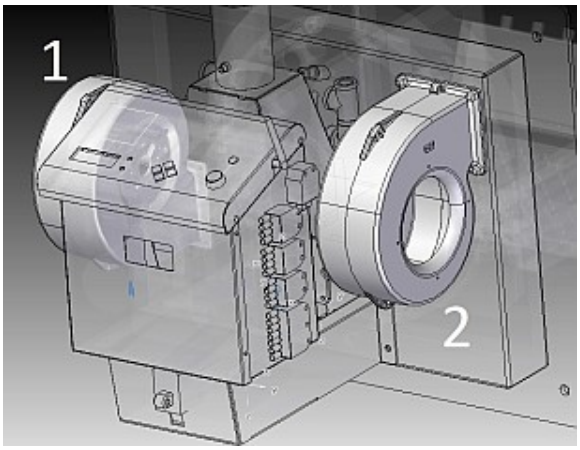
Parameter	Unit	PV 500
Fuel		Wood pellets 6...8 mm
Input power		
- burning at maximum	kW	560
- burning at minimum	kW	160
- holding flame	kW	40
Power supply		230/240V, 50/60Hz,16A
Electrical power consumption*		
- burning at maximum	W	600
- burning at minimum	W	160
- igniting	W	1100
- standby	W	20
Overall dimensions:		
- length	mm	1065
- width	mm	606
- height	mm	523
Burning chamber dimensions:		
- length	mm	585
- width	mm	506
- height	mm	452
Burner weight	kg	
- burning chamber frame	kg	30
- grates	kg	18
- ceramic tiles	kg	53
- burner body	kg	32
Burner weight with package	kg	130

2.1 Main components



Internal feeder

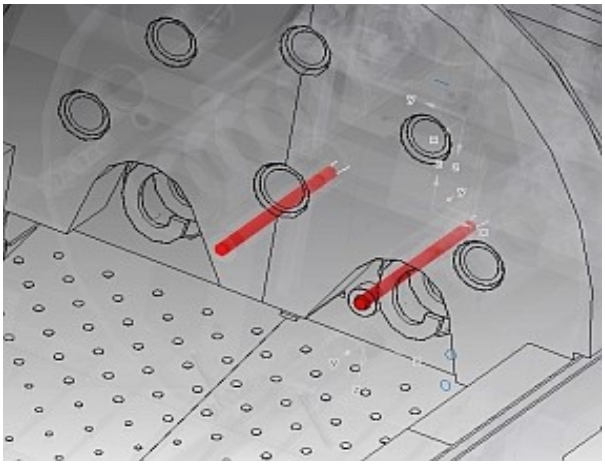
Internal screw feeders are used to deliver correct amount of fuel into burning chamber. Delivered fuel amount is regulated by periodical work of feeder gear motors.



Air fans

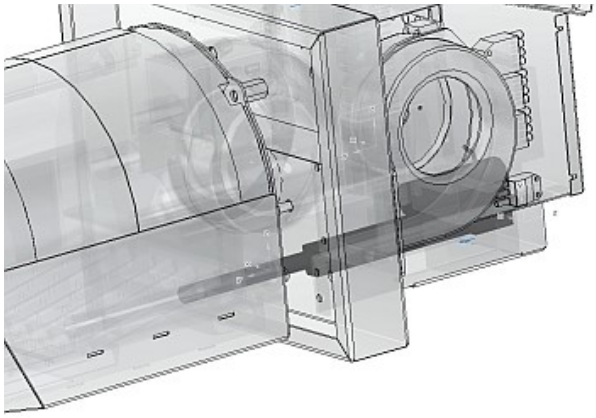
Primary fan(1) delivers main burning air needed for gasification of the fuel. Primary air is also used to burn down the gasified fuel (charcoal) and to ignite the pellets together with ignitors.Primary fan is located at left side of burner. Fan has single phase motor with capacitor located in motor connection box . For fan rotation speed measurement, there is installed magnet on fan axle and hall effect sensor near it.Primary fan power supply is connected through connector Y5 with control cabinet. Power supply line is modified with triac relay to regulate the power delivered to fan motor. Fan speed is depending about the delivered power. Fast melting fuse F2 on control board is used for protection. Rotation sensor is connected to connector “FAN” on control board.

Secondary fan(2) also delivers main burning air needed for gasification of the fuel. Rotation sensor is connected to connector “FDR” on control board. Secondary fan is connected through connector Y4.



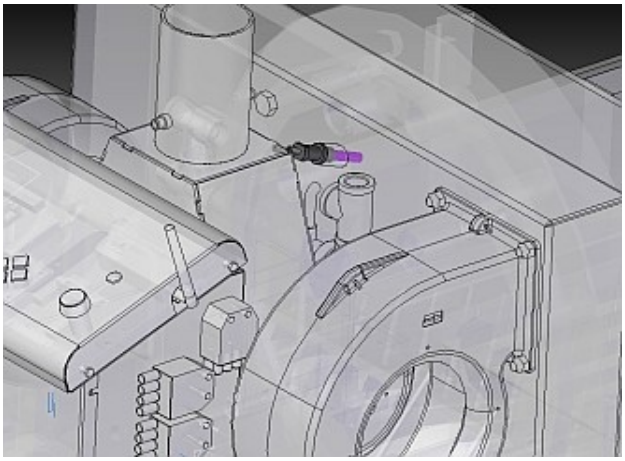
Igniter

Igniter´s main purpose is to ignite loaded fuel making the burning process start. Igniters electrical supply for PV700 is connected through connector Y9. PV500 has 2 igniters.



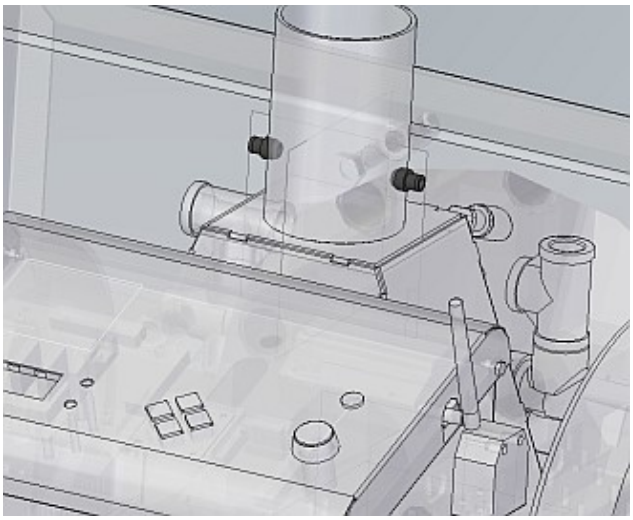
Linear motor

Linear motor moves the grates in burning chamber. It´s purpose is to move ash and half burnt pellets away from igniters and feeder.



Photocell

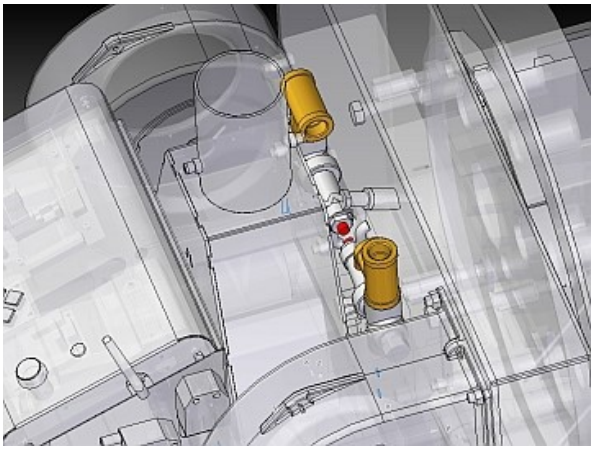
Photocell´s purpose is to recognize if there is flame in the burning chamber which gives signal to the controller to start igniters or not.



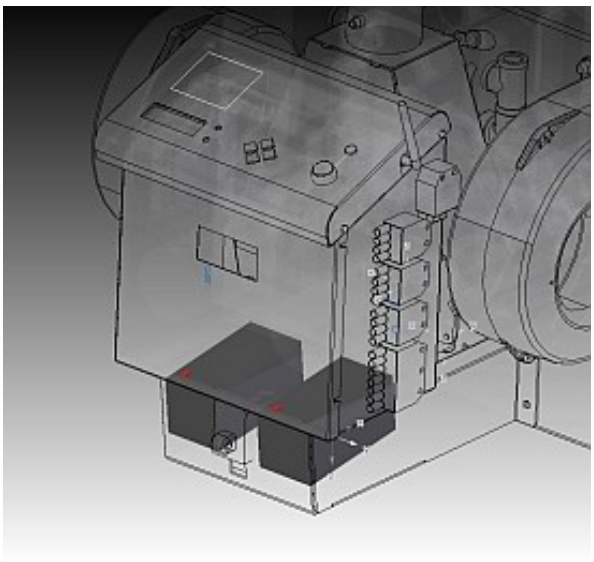
Level sensors

Optical fuel level sensors recognize the fuel level in the vertical pipe. Fuel is recognized when pellets pass the optical beam between optical sensors.

Water sprinkler

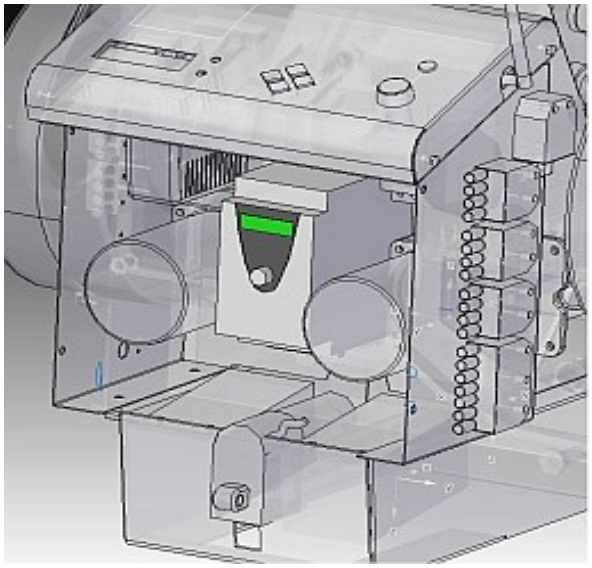


The sprinkler system is only activated when the temperature of inner auger rises dangerously high. Sprinkler system will spray water to extinguish the fire. The burning chamber must be cleaned from wet ash before turning the burner on again! Pressure hose and reservoir should be used with water supply, connection to the sprinkler is designed to be made with threaded 1/2 inch connection. System should stay active even when there is a power failure



Battery

When there is no power from the main power supply then the burner is operating from battery power. PV700 uses two 12V 3,4 Ah batteries with 6,3A fuse (F6).Because battery is a safety element, burner controls batteries condition and does not start next working cycle if the batteries voltage is too low.



Inverter for flue gas fan (optional)

Inverter is an electrical device that converts direct current (DC) to alternating current (AC). The converted AC can be at any required voltage and frequency with the use of appropriate devices, example: flue gas fan for PV burners.

2.2 Safety devices

The back-burning is the biggest danger risk at burners working procedure. Back-burning appears when usual pressure or draught conditions have changed in boiler's combustion chamber. There are several reasons for such changes.

In order to secure operational and fire safety the burner PV500 is equipped with following safety devices:

- **Back up batteries.** Enable to finish safely burning procedure in normal conditions or during unexpected black out in mains supply.
- **Melting hose.** The external auger is connected to the burner with a special hose (Ø 76mm), which is made from easily melting polyurethane material that interrupts when back-burning takes place. Such measurement avoids entrance of the flame from burner into external auger and pellets container.
- **Thermostatic sprinkler valve.** Enables to extinguish the fire in feeder's augers tube by spraying water into it, when burner is overheated due to possible back-burning or any other reason.
- **Fire safety water pressure control switch.** Enables to keep necessary water pressure in water reservoir and to ensure with that successful extinguishing procedure when needed.
  Pressure control switch allows starting the burner only if water supply is present and pressure exists.

2.3 Pellets

Wooden pellets or saw dust granules are concentrated and homogenized wooden fuel made from sawdust and cutter shavings. Pellets are pressed with high temperature. No extra materials are added, pellets are held together by a natural ingredient found in wood – lignin. Pellets are neutral, renewable fuel. Its burning doesn't spoil CO_2 balance in the atmosphere. Only premium ENplus-A1 pellets can be used in PV500. Pellets must be stored in a dry and ventilated room. Some key data for industrial and premium wooden pellets are given in Table 2.

Table 2 Pellets' key data

	Premium pellets	Industrial pellets
Raw material	Stem wood, wood processing industry residues	+ whole trees, bark, logging residues
Calorific value	4700-5100 kWh/ton	ca 4700 kWh/ton
Volume weight	ca 650-670 kg/m^3	>675 kg/ m^3
Volume of 1 ton pellets	1.5-1.6 m^3	ca 1.5 m^3
Diameter	6-10 mm	6-12 mm
Length	3-5 x diameter	ca 4mm
Water content	8-10 %	ca 5 %
Ash content	ca 0,5%	ca 2%
To replace 1000 l light oil	ca 2 tons or 3 m^3	ca 2 tons or 3 m^3

3 Installation

3.1 Pre requisites to boiler and boiler house

In order to install the burner, the boiler must meet to the following requirements:

- It is recommended to use three pass boilers.
- The construction of the boiler must make it possible to open the door of the boiler with the burner connected and removing ash from the furnace. If the door of the boiler is too narrow for opening it with the burner, then extra hinges must be installed.
- If there is not sufficient (less than 5Pa) negative pressure in the furnace, a draught fan should be installed for the exhaust gases.
- The boiler must be positioned in a way that there is enough space for cleaning the burner, the boiler, the smoke pipe and removing the ash.
- Boiler door must have openings for feed screw, air holes etc and four 13mm holes for fixing the burner. See and Figure 1 and Table 3
- The boiler room where the burner is installed must fulfil all rules and recommendations given by local authorities.
- Boiler room must provide constant air amount of 1500 m^3 per hour i.e ca. 1600 cm^2air inlet opening is needed.

Note: If the burner is installed to the boiler, the door or the installation flange´s thickness should be 8-14mm.

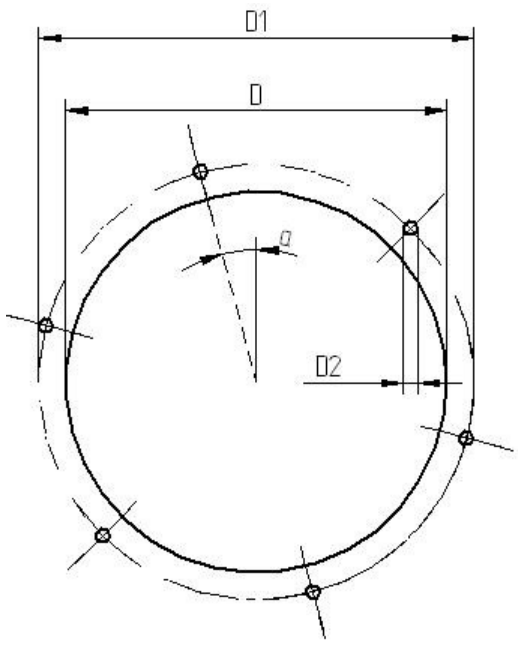


Figure 1 Placement of mounting holes

Table 3 Diameters of holes

	Unit	PV500
ØD *hole for burning chamber neck*	mm	350
ØD1 *flange bolt ring diameter*	mm	400
ØD2*bolt holes*	mm	6x13
a *bolt hole offset angle*	deg	15
angle between bolt holes	deg	60

Boiler firebox depth must be at least 2 times longer than length of the burner's burning chamber. The minimal length of the firebox L has to be 1200 mm. The height of firebox must leave at least 100 mm for ash below burning chamber. Minimum dimensions for height: 560mm.

Pellet burners need regular cleaning and therefore boiler construction must allow easy opening of boiler's door without removing the burner. The minimum size of opening in boiler's door depends on the position of door hinges. Figure 2below illustrates the situation. Point C is critical point.
In order to keep door width minimum and boiler's door opening small, a double hinge solution can be used. As double hinges add another degree of moving-freedom, door must be fastened on both sides. Slide-out doors with guide rails is also an option.

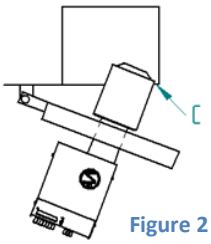
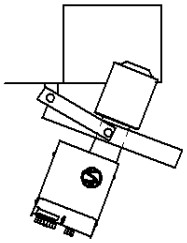
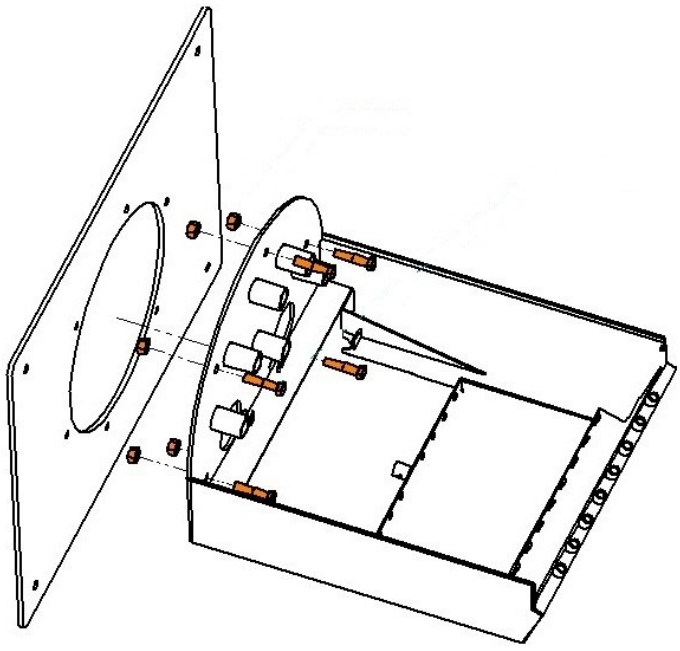


Figure 2 The burner has to reach out of boiler

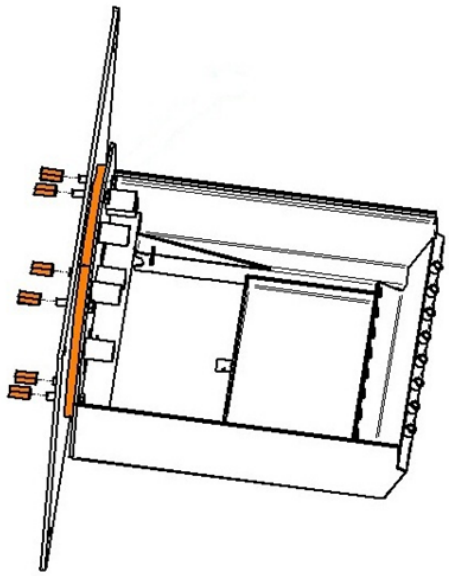
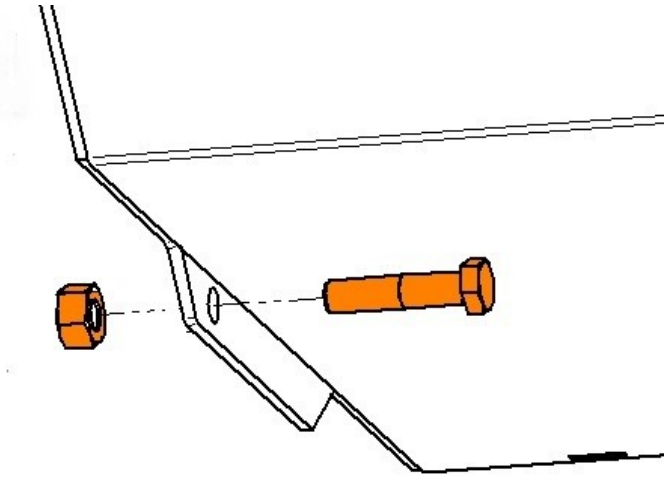


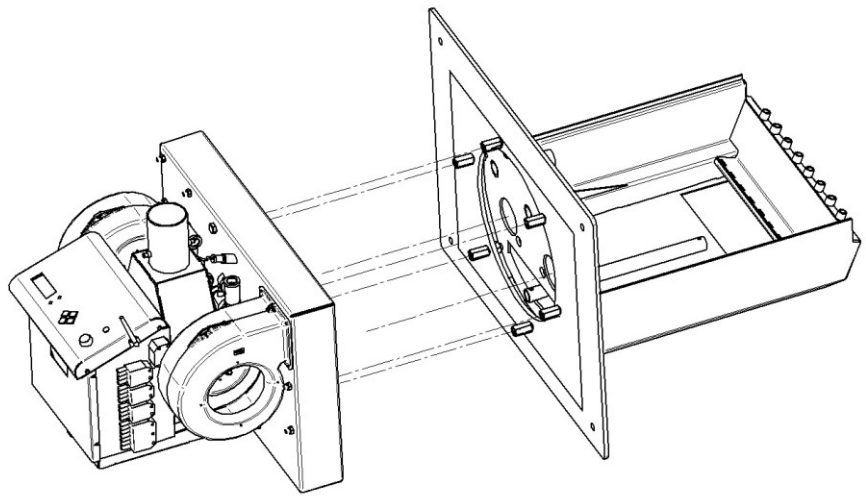
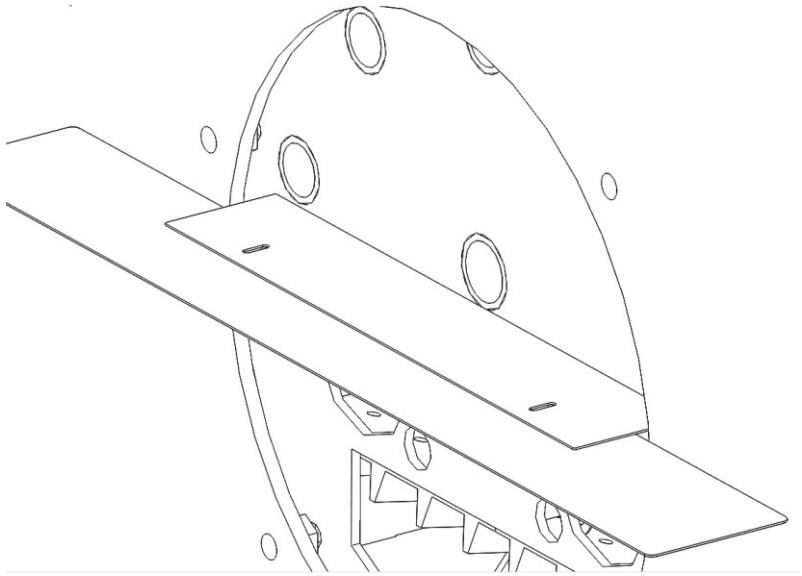
Double hinges

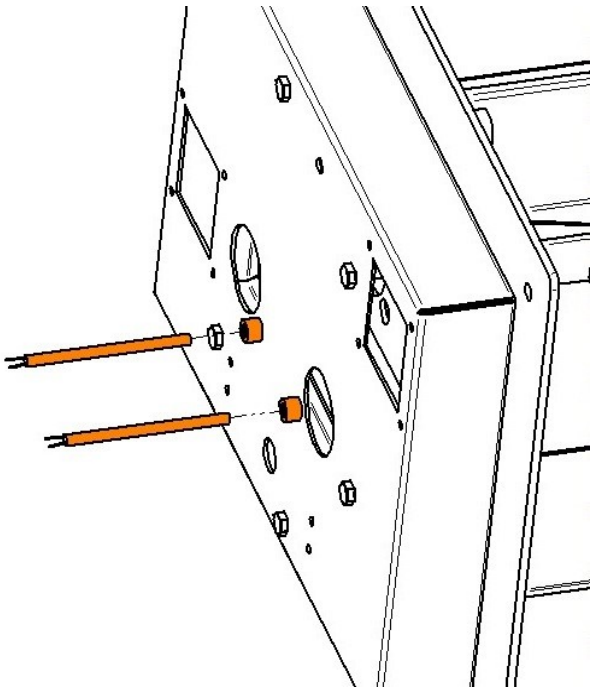
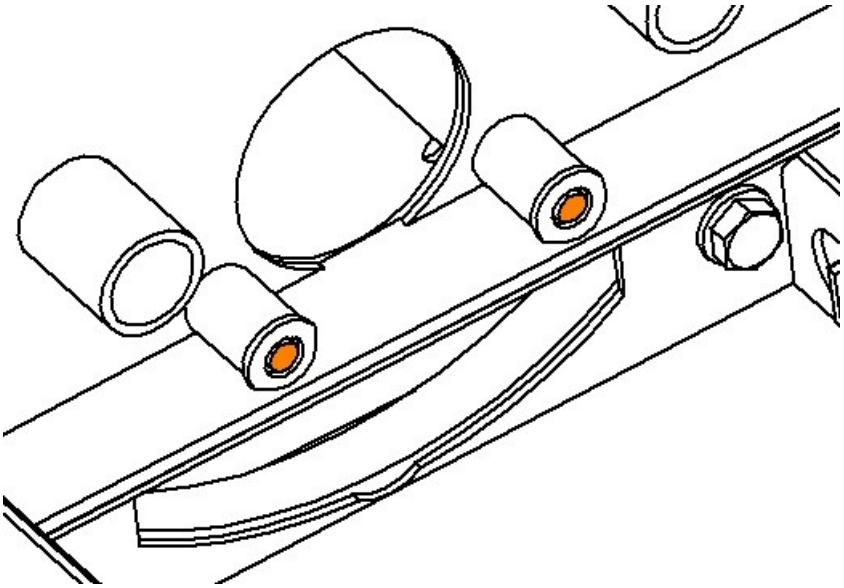
3.2 Burner installation

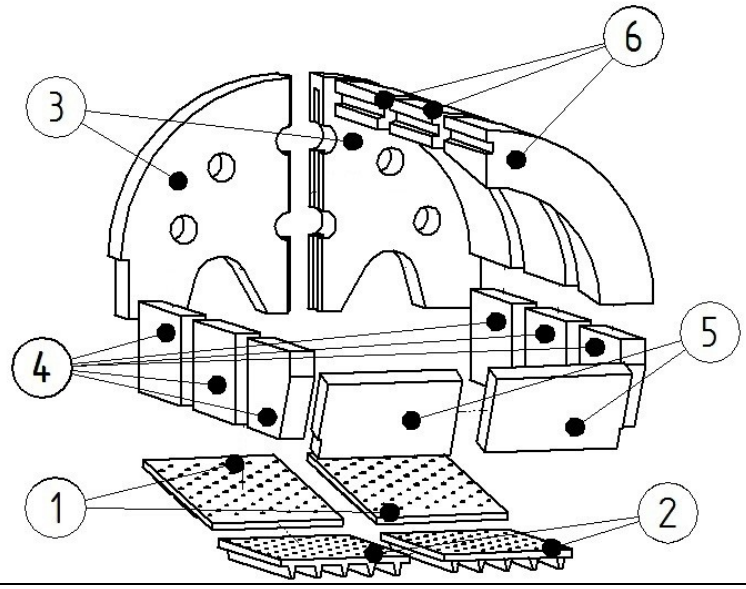


1) Install the burning chamber to the boiler door or to the flange using M12x45 bolts, distance washersbolts and coupling nuts. Do not tighten the bolts.

	**2)** Install the sealing rope (15x15mm) between the burning chamber and the boiler door (or flange). Use heat resistant sealant between flange and boiler. Tighten the bolts.
	**Notice!** One attachment for the bolt and the distance nut is positioned under the burning chamber.

	**3)** Install the backside using M12x70 bolts and washers to the burning chamber coupling nuts. Ceramic sealing must be placed between pellet burner and boiler door (or flange). The feeder tube must go through the hole on the back wall of burning chamber.
	Air separator devides primary and secondary air fan´s air flow to the burning chamber. Air separator must be regulated towards the burning chamber wall that there would be no gap between air separator and burning chamber wall.

	**4)** The tips of the igniters must reach as deep into the burning chambers internal feeding screw. Ensure the tips of the igniters are not touching any metal parts inside the burning chamber. Fix the igniters in place with a screw.
	Notice! The tips of igniters have to be on same level with tubes ends holding them



5) Install the ceramic tiles and the grates on to the burning chamber in order as shown in figure.

3.3 Water sprinkler

Principal chart of water sprinkler installation is depicted in Figure 3.

Water sprinkler is main safety element against back-burning. It is strongly recommended to install sprinkler system. Pressure switch allows starting the burner only if water supply is present. If no water is available on installation site, reservoir can be filled manually. In this case, pressure switch is not connected to safety circuit as there is no pressure in water system. In case of back- burning, sprinklers will open and extinguish fire in feeder auger's tube. Flow control valve limits the amount of water flowing into burner after the reservoir is emptied.

Caution! The burning chamber must be cleaned from wet ash and pellets before turning the burner back on again.

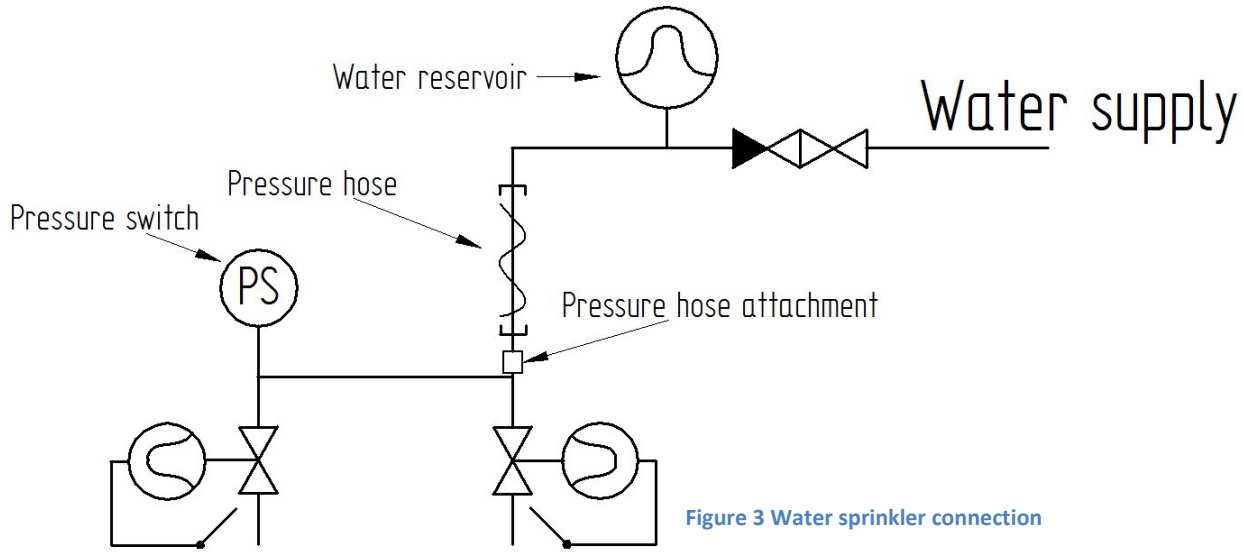


Figure 3 Water sprinkler connection

3.4 External auger

A feeding auger transports pellets from the pellet container to the burner. The burner controls the work of the auger. The auger is connected to the burner with a special hose (Ø 80), which is made from easily melting material that acts as a safety measure against back-burning. PV500 fuel consumption at full power is 146-156 kg of pellets per hour (2,4-2,6 kg per minute). External auger´s productivity must be at least 190kg of pellets per hour. The auger can be fixed to a storage container or a ceiling depending on the conditions at the installation site.

- While installing the auger you must keep in mind that:
- The raising angle of the auger must not exceed 45°
- The end of the exit tube of the auger and the input of the burner must not be aligned. The recommended minimal horizontal distance is 20cm.
- The distance between the input of the burner and the exit tube of the auger must be at least 60cm vertically – recommended distance is 80-200cm.
- Hose between auger and burner must be tight, otherwise pellets will block the auger. Falling angle must me between 65° and 85°.

All critical requirements to installation of external auger are depicted in Figure 4.

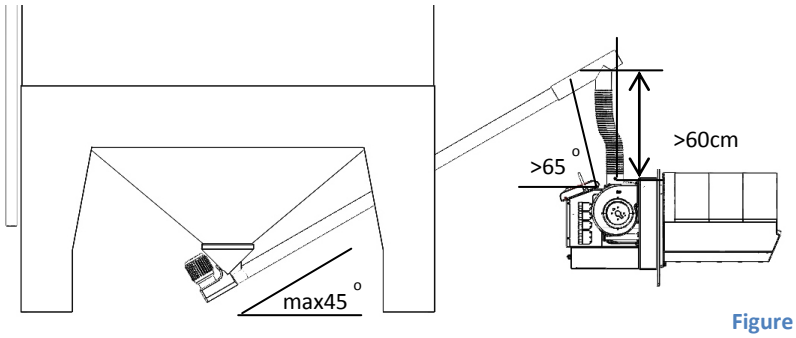


Figure 4 External auger connection

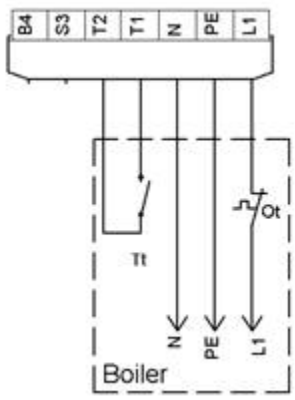
3.5 Pellet storage

Pellets must be stored in a dry and ventilated room that is separated from the boiler room. A tailor made silo for particular storage is recommended. All safety regulation must be taken into consideration according to the local laws. It is recommended to wear a respirator when handling pellets. Refilling must be carried out before the storage runs empty.

3.6 Electrical connections

Following connections must be done by the electrical installer:

- 1-phase supply and boiler's thermostat to socket Y1.
- 3-phase supply to socket Y2
- External auger to socket Y3



The burner is equipped with a standard oil burner plug that has 7 contacts. Usually the burner is connected to the boiler with a 5-wire cable according to Figure 5 .

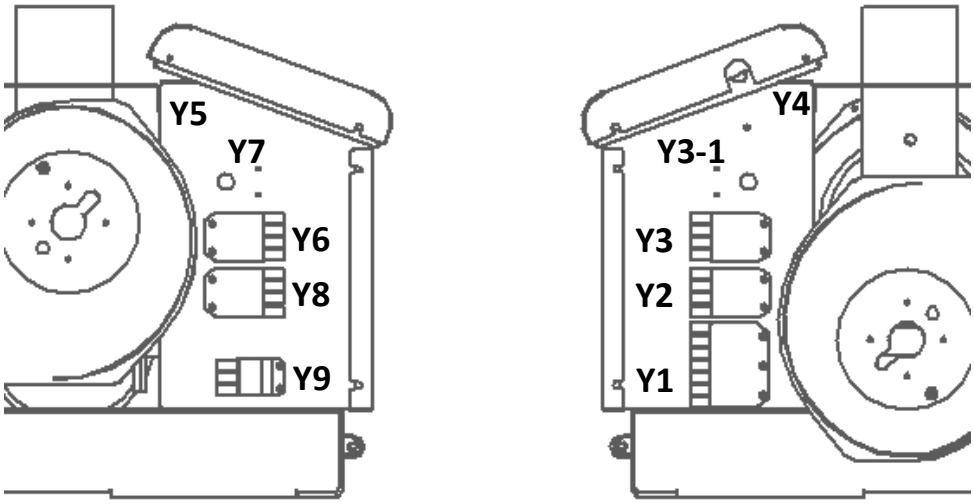
Tt - bolier's thermostat

Figure 5 Thermostat connection

Burner is designed to work at 230V single phase supply (socket Y1). External auger is supplied by separate 3-phase 3x380V power (socket Y2). Boiler should be equipped with thermostat or external switch what has to be connected to pins T1 and T2 in 7- pole plug Y1 for turning on/off the pellet burner. Feeder auger's motor is equipped with motor thermal protection, which prevents motor from overheating. As soon as the nominal trip temperature (TNF) of the sensor set-point is exceeded, the relay detects this variation and the output relay cuts off the power to the motor. Burner can be equipped with optional lambda sensor. It provides efficient control for optimal performance concentrating emissions and burning efficiency.

Table 4 Sockets on control panel

Socket	Description	Color No of poles	Data
Y1	Power input	Black/brown 7-poles	230V 16A
Y2	Power input	Black 4-poles	3x380V 4A
Y3	External auger 1	Black 4-poles	0,55kW 1,6A
(Y3-1)	External auger 2	Black 4-poles	0,55kW 0,65A
Y4	Secondary fan	White 4-poles	0,15kW 0,65A
Y5	Primary fan	White 4-poles	0,15kW 0,65A
Y6	Lambda sensor	Green	
Y7	External inverter or ash removal	White	
Y8	Flue gas fan	White	3x230V 0,75kW max 4A
Y9	Igniters	Black 3-poles	2x500W 2,2A



3.7 Initial start-up

Prior to the initial start-up of the burner make sure that:

- The burner is connected to the boiler.
- The boiler thermostat is installed and functioning properly.
- The external auger of the burner is installed and connected to the burner.
- The smoke duct is connected to the chimney, the dampers for smoke gases are open and there is sufficient draught. When the burner is operating, the negative pressure inside the furnace must stay between 5-20 Pa.
- Sprinkler system is connected and pressure switch connected to safety circuit.
- Phase (L) and neutral (N) wires in power cable are connected properly.
- Extension board is connected to main controller by 2 wires TMP2 and TMP 3 as shown Figure 6 below.

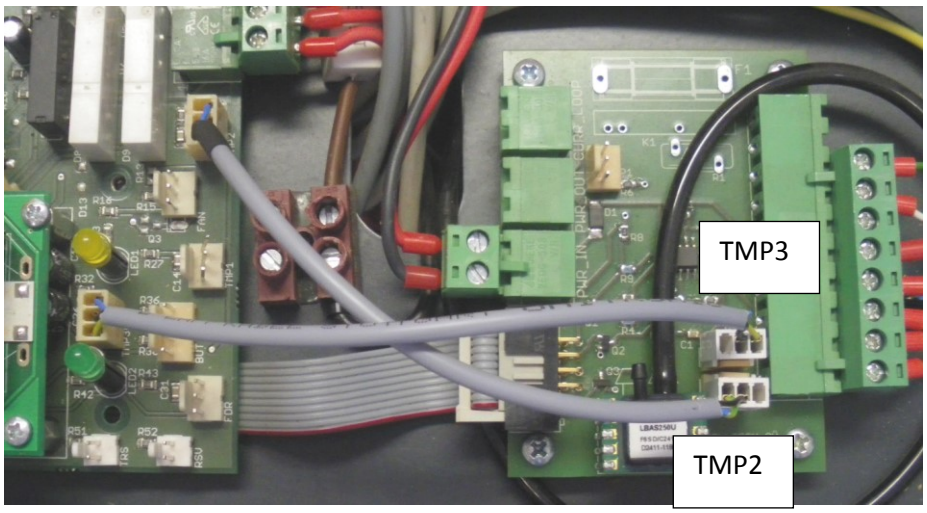


Figure 6 Extension board connection

4 Optional components

4.1 GSM modem

Modem enables users to send up to 5 phone numbers the SMS messages with burner's error or status info on 8 rows. Following products are needed to set up modem:

1 – Modem signal converter EP0005, connected between modem and UART plug. See.

2 – Modem EP0007

3 – Modem power cable EP0001

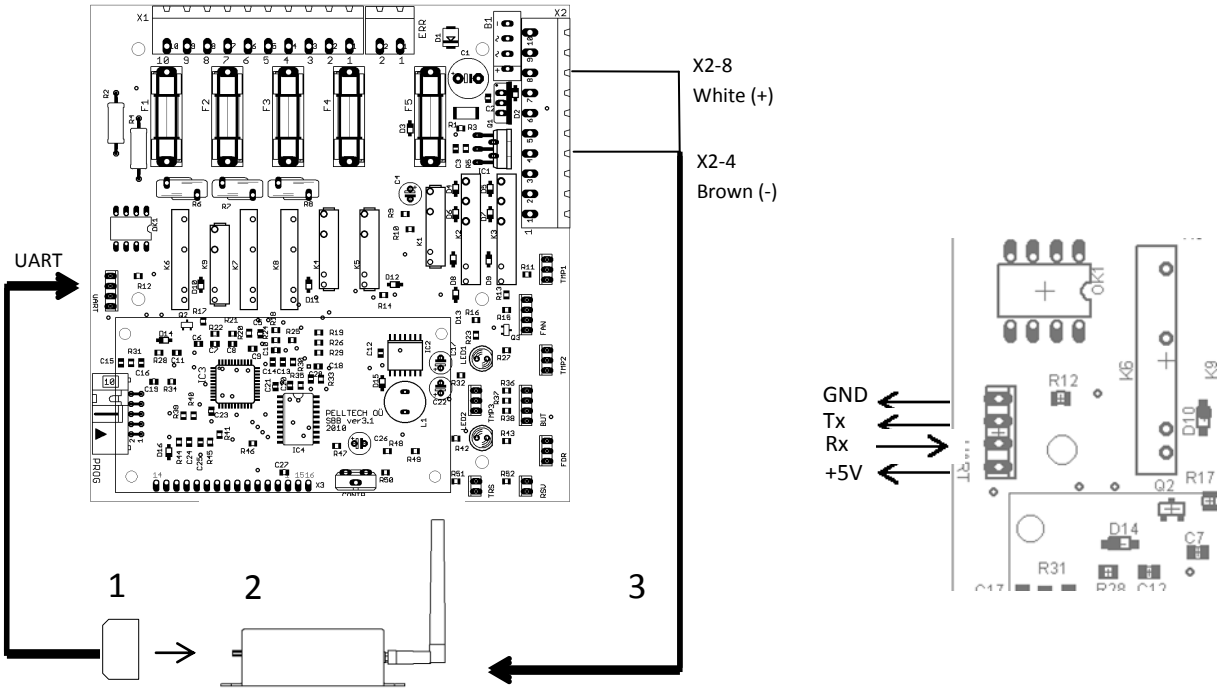


Figure 7 GSM modem connection

Modem is connected according to diagram in Figure 7. Power supply cable is connected to pins X2-8 and X2-4. Adaptor EP0005 is connected with modem and controllers UART- plug. Depending on the location of the modem, extension cables may be needed.

Before inserting the SIM card to burner the following actions have to be done:

1. SIM card must by activated by the mobile operator
2. PIN code request has to be switched out.
3. Check by using mobile phone that it is possible to send SMS with this SIM card.
4. In SIM card´s phonebook must be only the numbers, where to the messages from the burner will be sent.

Figure 8 SIM card insertion

To insert the SIM card, the modem has to be disconnected from supply mains. To insert the card push it into a slot as long as its spring clicks. See Figure 8 . To remove card push it in as long as spring clicks and pushes it out.
In order to activate SMS sending, in burners menu PAR52 has to be changed. Value shows for how many numbers the message will be sent. “0” means no messages to be sent. “2” means that messages will be sent to 2 first recipients in SIM card.

Modem has two indicators. Green one shows that modem is turned on. Red one shows modem status. Modem’s statuses are described in Table 5.

Table 5 Modem statuses

Red LED indicator	Modem status
Permanently on	Sending message (on-going call)
Fast interrupt sequence (period 0,5 s Ton 1s)	Net search/Not registered/ Turning off
Slow interrupt sequence (period 0,3s Ton 3 sec)	Registered full service
Permanently off	Device is turned off

4.2 Error output

It is possible to connect to burner additional device like pump or modem, what switches a device on or off when error occurs in burner. The error output is marked with ERR and is located on controllers upper part. Red arrow on Figure 9 shows placement of the error output.
It is allowed to switch up to 5A @230VAC device to circuit.
PAR50 in burner’s parameters menu defines weather the error circuit is open or closed when error occurs. 1 means ON – opened when error, and 2 means OFF – closed when error occurs. See Table 6

Table 6 PAR50 value

PAR50 value	Description
1	Normally open circuit. Turns ON when error occurs.
2	Normally closed circuit. Turns OFF when error occurs.
3	Turns ON in IGNITING, HEAT UP, BURNING and HOLD FLAME statuses.
4	Not in use
5	Not in use

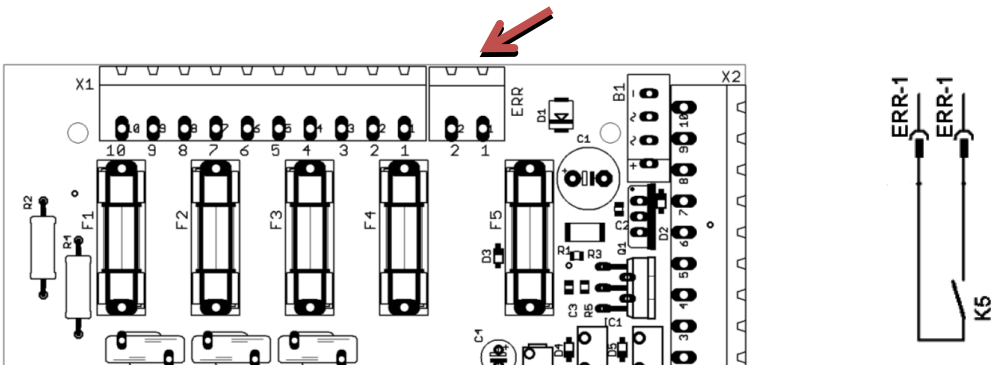


Figure 9 ERROR output

4.3 Flue gas fan

The burner needs stable under-pressure in burning chamber for its correct operation. Simplest way to assure this is to use the flue gas fan between boiler and chimney. With flue gas fan the burner can control and hold constant under-pressure. In order to control flue gas the PAR60 value has to be set to"2" ON. Selected flue gas fan must provide transmission of the maximum flue gas amount and exceed the pressure provided by boiler, ash cyclone and chimney. The flue gas capacity for burned pellets can be calculated by simplified formula.

$$V = \frac{P \cdot \lambda \cdot T_{fg}}{T_{room}}$$

V – Capacity range in m³/h
P – Burner max power in kW
T_{fg} – Flue gas absolute temperature in K
T_{room} - Room absolute temperature in K
λ (lambda) – Excess air ratio
PV burners are designed to work at lambda values 1.2...1.5 - for calculations choose value of 1.5.
Flue gas fan must be installed between boiler and chimney. If ash cyclone is used then flue gas fan must be installed between ash cyclone and chimney to avoid overpressure in cyclone and smoke leakage.

Burner setup

Depending on burner's configuration (weather inverter included or not) the electrical connections may be different. In case the frequency inverter has already been installed in factory to the burner, the flue gas fan can be directly connected to the burner through connector Y8. Fan must be connected to burner with 3-wire cable (3x1. 5mm²). Internal inverter output is 3 x 230V. If flue gas fan motor is a three phase motor (3 x 230/380V) then it has to be connected as triangle.
In case the burner has on inverter, the external inverter for flue gas fan can be used.
Inverter must be selected according to fan motor's parameters and available power supply. The inverter must be switched to sink logic (negative common).
To connect the external inverter with burner there is connector Y7 with 3 output signals:

- T1 - burner DC common (ground), must be connected with external inverter input common.
- S3 – inverters “run” command, must be connected with F (forward) pin on inverter input. Burner will connect this pin to ground when fan must run.
- B4 – 0… 10V output for fan speed, must be connected with inverter analog input.

Inverter setup

Inverter parameters are set up at factory for automatic control. To test flue gas fan manually:

1. Press Easy button on inverter
2. Press dial button and change settings :
   CN0d - “0”
   FN0D – “0”
   F174 – “0”

4.4 Oxygen amount sensor

Following instruction is applicable for firmware version 3.88 or later. Oxygen amount sensor (oxygen sensor) allows the burner to keep predefined oxygen levelin flue gas, what increases the efficiency of the burning procedure.
In order to implement sensor what measures the amount of oxygen in flue gas (Oxygen amount sensor), two parameters PAR66 and PAR67 in parameters menu have to be set-up according to Table 7:

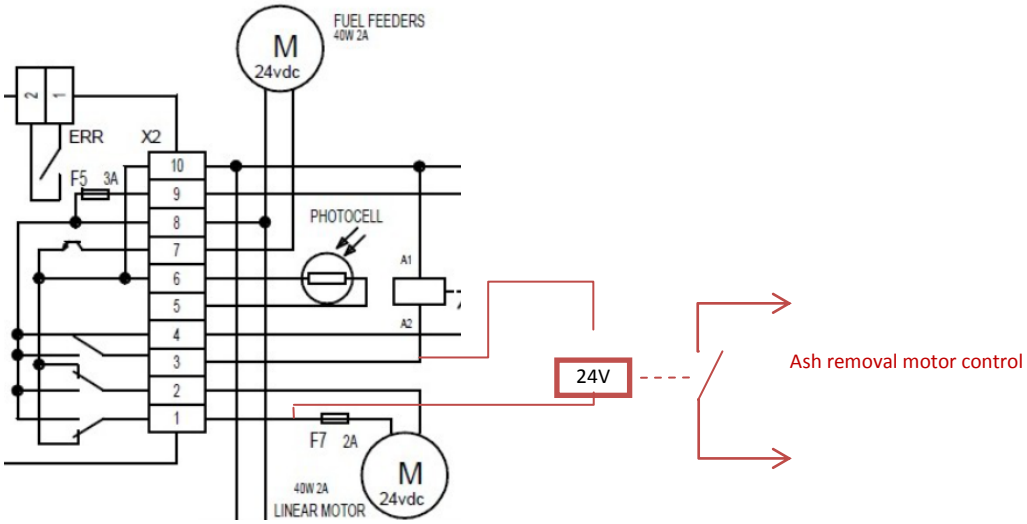
Table 7 PAR66 and PAR67 set-up

Parameter		Description	Unit	Value		
No	Name			Def	Min	Max
PAR66	OXYGEN TYPE	0 – no sensor 1 – 4…20mA = 0…25% oxygen 2 – 4…20mA = 0…20% oxygen	-	0	0	2
PAR67	OXYGEN SET	Oxygen level set-point	-	6	4	12

For oxygen amount sensor EP0006 in parameters menu, the PAR66 value has to be set to “1”. Some third party oxygen amount sensors use 4…20mA output for 0…20% oxygen. In this case, value “2” must be selected.
If PAR66 is set to “0” (no sensor), secondary fan is driven by air table set in PAR31 – PAR36. Secondary fan also switches back to air table if oxygen level reading is below 3% or over 19%. Oxygen sensor is located inside the burning chamber. Oxygen level control starts 5min after burner enters into BURNING status. It can take about 10min for oxygen level to stabilize.
Oxygen level can be seen in INFO-menu next to pressure reading. The value on the screen must be divided by 10 to get the real value. For example “O2=113” means oxygen level value 11.3%.

4.5 Ash removal system

The burner can control external ash removal motor via grate motor connector. 24V NO (normally open) relay must be connected in parallel to grate motor. During cleaning cycle, the relay is powered and switches on external boiler ash removal motor.



4.6 External boiler temperature sensor (TMP1)

External temperature sensor enables the burner to maintain constant boiler's water temperature. For that external temperature sensor has to be installed to relevant place on boiler, existing burner's temperature sensor to be disconnected from TMP1 connector on controller's board and external sensor to be connected to connector TMP1. In parameters menu PAR53 value has to be chosen "2".

When temperature holding status is activated, then burner will change its capacity according to water temperature and speed of temperature changing. Burner starts to change its capacity when BURNING status has lasted longer than set in PAR15. Capacity is changed after time set in PAR17.

Following actions must be done to enable temperature hold mode (THM):

1. Mount external temperature sensor to boiler according to boiler manufacturer instructions.
2. Connect the sensor to TMP1 connector on controller board.
3. Choose PAR53 value (sensor type) according to Table 8.
4. Set requested temperature – PAR54. It should be lower than boiler thermostat temperature. Otherwise the boiler thermostat would force the burner to turn off before reaching PAR54 value.
5. Optionally PAR55 - the hysteresis of requested temperature can be changed.

THM activates if PAR53 value is larger than "1" and BURNING status has lasted longer than set in PAR15 typically 30min). The burner will change its output power according to current measured temperature and the rate of temperature change. New power level is selected after every time interval specified in PAR17.

Table 8 PAR53 values

PAR53	Sensor type	Temp min	Temp max	Function
0	No sensor	-	-	-
1	0..2.5V	0ºC (0.5V)	125ºC (1.75V)	Burner's existing internal over temperature sensor. Overheat value to be set PAR43.
2	0..2.5V	0ºC (0.5V)	125ºC (1.75V)	Boiler temperature control with external sensor

After activating THM, following row is displayed on INFO-screen e.g.: „T=22.3/70±5↓200°". It means following:
22.3 – Actual measured temperature.
70 – Set point temperature (PAR54).
±5 – Set- point hysteresis (PAR55).
↓ - Shows weather actual temperature is increasing or decreasing.
200° – Forecasted temperature in 10min.

5 Operation and service

5.1 User interface

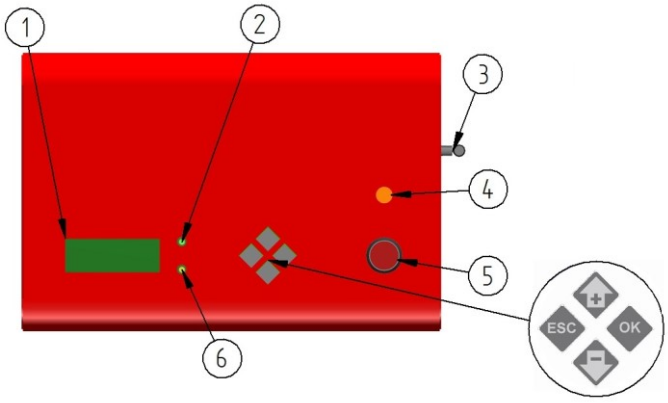


Figure 10 User interface

1. 2-row LCD display.
2. Yellow LED, indicates presence of flame in the burning chamber.
3. GSM modem antenna (option).
4. Orange burner operation light indicates if the boiler's thermostat is switched on or off.
5. Red burner on/off switch with power indication light. Enables to switch boilers thermostat on/off.
6. Green LED, indicates existence of the fuel in the burner.

The burner is controlled via user interface on the front panel Figure 10. LCD screen (1) displays settings menu, event log etc. Yellow light (2) shows the presence of flame in burning chamber. Or if blinking, the burner is out of normal operation. Status can be seen on log screen. Green light (6) indicates if there is fuel in the burner. To move in menus, use up and down buttons, to change parameter, press OK, to go back to STATUS MENU press "ESC" button. Functionality of buttons depends on time of pushing.
See Table 9.

Table 9 User interface controls

Button	Push time	Action
OK	<3s	To enter to submenu To confirm settings (in parameter edit mode)
OK	>3s	To reset error, resume normal operation To reset counter (only in counter screen in INFO menu)
ESC		To move back in menu by one level To cancel change (in parameter edit mode)
OK+ESC	>3s	To reset burner

5.2 Starting and stopping

To turn on the burner, turn on the boiler main switch. If burner displays STOPPED, then go to STATUS menu and change parameter BURNER from ON to OFF. The display shows WAITING. Now turn boiler thermostat to desired temperature. The burner will go to TESTING and then to LOADING-state. If this is the first run, external auger needs to fill up with pellets. It may take as long as 20minutes.

To stop the burner, set in main menu BURNER from ON to OFF. Now the burner will burn all pellets in burning chamber and turn safely to standby.
STATUS menu displays the changes:
BURNING → END BURN →END BLOW→ WAITING → STOPPED
The stopping procedure may take up to 30 minutes.
Attention! If necessary the boiler's thermostat can be turned on/off from burner red switch with power indication light.
Caution! Do not turn off mains power to terminate burning process. Use the boilers thermostat for that. In order to complete burning procedure safely let the burner to burn all fuel in burning chamber. Never leave burner unattended when you had to stop boilers work turning boiler off from mains switch in any reason.

5.3 Fuel refilling

Fuel container has to be refilled before its runs out. The fuel can be added any time to container. If container runs out before refilling, refill it and restart the burner. The start-up takes now longer about 20 minutes, because external auger has to be filled with pellets like in initial start-up. Turn burner from BURNER menu ON. Vice versa the LEVEL ERROR is displayed, because loading time is exceeded.

5.4 Statuses and parameters

PV350 pellet burner operates in many different states, which are called "Status". Log screen STATUS menu displays last and actual events (burner statuses) and their duration. Burner changes its statuses based on received input signals from sensors and values set by user. The statuses in typical working order of cycles are given in Table 10. The duration of all actions are in form mm:ss ('m' in the middle) or hh:mm ('h' in the middle). For example: 'IGNITING 01m25"means the burner ignition state lasted 1 minute and 25 second. Lower row of the log shows burner's current state. To reach the lower row, press the "down"(↓) button, until you reach the lower row with current state. The duration of current state updates every second or every minute. Changed data blinks.

Table 10 Summary of burner statuses

Status	Short description
WAITING	Waiting when boiler's thermostat switches on.
TESTING	Boiler's thermostat is switched on, testing the battery, fans, feeder, level sensors and draught in progress.
CLEANING	Ash removing from burning chamber.
LOADING	Loading pellets with auger into burner and by feeder into burning chamber.
IGNITING	Igniter is turned on, pellets are ignited.
PRE-BURN	Flame is recognized, small amount of pellets are added by feeder auger.
HEAT UP	Burning chamber ceramic stones are heated slowly up.
BURNING	Normal burning operation.
HOLD FLAME	Thermostat is switched off, small flame is held alive.
END BURN	Thermostat is switched off, feeder is burned up.
END BLOW	Pellet coals in burning chamber are burnt, flame has disappeared.
WAITING	Burner waits when boiler's thermostat switches on..

At **WAITING** status, the burner waits for boiler's thermostat switching on. There is no time limit for WAITING status. Only feeder auger is working periodically at WAITING status and makes ½ rotations after every 2 minutes. With this feeder augers spiral cleans feeder's tube from wastes.
When boilers thermostat switches on, burner will go to TESTING.
At **TESTING** status, burner's integrity and important device functioning are checked. List of tests is given in Table 11 .

Table 11 List of tests in TESTING status

PAR No	Test name	Test conditions
-	Battery voltage	Battery charging is turned OFF and feeder auger is turned ON. Battery voltage must be greater than 24V.
PAR46	Feeder auger's current	Feeder is turned ON – feeder current must be smaller than set in PAR46 .
PAR62	Draught	All fans are turned on. Draft must be under PAR 62.
PAR4	Primary fan	Fan must rotate faster than 37rot = 40 (PAR4) – 3.
PAR34	Secondary fan	Fan must rotate faster than 37rot = 40 (PAR34) – 3.

At **CLEANING** status, the linear motor (actuator) moves the grates and pushes the ash and residues out of burning chamber. CLEANING parameters are desctibed in Table 12.
The CLEANING cycle might be divided into 2 steps:

1. Grates are pulled fully in to end of burning chamber's burner side.
2. Grates are pushed fully out to end of boiler's side.

Attention! Depending on polarity of connection of linear motor steps can be changed.

Table 12 CLEANING parameters

PAR No	PAR name	Value	Unit	Test conditions
PAR48	Cleaning cycle interval	0...250	min	BURNING time between CLEANING cycles. If set to 0 then CLEANING is turned off. If BURNING has been longer than 2x Par 48 set, then extraordinary cleaning will made.
PAR47	Linear motor's max. current	0.2..6	A	Linear motor's maximum current level. If greater, then motor is stopped and cleaning cycle is started again.

At the **LOADING** status, external auger is turned on. When pellet level in the burner reaches to level sensors, feeder auger is started. Feeder auger loads necessary amount of fuel needed for ignition into burning chamber. Amount of loaded fuel is measured by counting rotations of feeder auger. LOADING cycle is ended when feeder has made exact number of rotations, pre-set in parameter PAR24 (loading feed). LOADING parameters are described in Table 13.

Table 13 LOADING parameters and timing

PAR No	Parameter name	Default value	Unit	Comment
PAR24	Loading feed	35..40	rot	Feeder rotations needed to load pellets into burning chamber. Depends from burner model.
PAR25	Loading 2 feed	5	rot	Feeder rotations for second loading.
-	Max loading time	5	min	Feeder auger's maximum regular loading time.
-	First loading time after manual start	20	min	Feeder auger's maximum loading time after manual start.
-	Auger start	3	sec	Auger Start delay if no fuel in burner.
-	Auger stop	3	sec	Auger Stop delay if fuel in burner.
-	Feeder start	1	sec	Feeder auger Start delay if fuel in burner.
-	Feeder stop	4	rot	Feeder auger rotations made without fuel level before stopped.

At the **LOADING** time, external auger holds permanent fuel level in the feeder auger's tube. Depending on the level sensor signal, the external auger is turned on or off.
Feeder auger's work depends also on fuel level sensor signal.
Maximum loading time is limited by 20 minutes after manual (initial) start up because extra time for external auger filling is needed. In next loadings, maximum time is limited by 5 minutes.
If maximum loading time is exceeded and silo selection on burner is used, the pellet delivery will be switched to other external auger. In single pellet container delivery system NO PELLETS error will occur.
At **IGNITING** cycle the igniter is heated up and fan blows hot air on pellets in burning chamber. Hot air ignites pellets. Igniter is working periodically at ignition time in order to avoid its overheating.

Igniter is pre-heated already in the end of loading cycle. When internal auger has made 10 rotations (full number of load rotations is 12) the igniter is turned on for pre-heating. If the igniter has been turned on more than 1 minute at LOADING time, then it will be turned off.
IGNITING parameters are described in Table 14 .

Table 14 Ignition parameters and timing

PARNo	Parameter name	Default value	Unit	Comment
PAR8	FAN@IGNITING	25	rps	Primary fan speed at ignition.
-	Max ignition time	255	sek	Maximum ignition time.
-	Time of first loading	20	min	Maximum loading time after manual start.
-	Auger start	3	sec	Auger Start delay if no fuel in burner.
-	Auger stop	3	sec	Auger Stop delay if fuel in burner.
-	Feeder start	1	sec	Feeder Start delay if fuel is in burner.
-	Feeder stop	4	rot	Feeder rotations made without fuel before stopped.

The purpose of **PRE-BURN** status is to create stabile flame and assure effective pellets burning procedure after ignition. Minimum fuel amount is added periodically at pre-burn time. Fans are working with same speed as at IGNITION. Feeder auger makes ½ rotations at every 25 sec up to 6 rotations achieved. PRE-BURN parameters are described in Table 15.

Table 15 PRE-BURN parameters

PAR No	Parameter name	Default value	Unit	Comment
PAR8	FAN@IGNITIG	20	rps	Primary fan speed at IGNITING and PREBURN
PAR39	FAN 2 MIN	7	rps	Secondary fan's minimum speed. Used at IGNITING, PRE-BURN, HEAT UP, HOLD FLAME and END BLOW statuses.
PAR41	PRE-BURN	25	s	Length of one PRE-BURN cycle.
PAR42	PRE-BURN CYCLES	6	x	Number of PRE-BURN cycles.
-	Pre-burn feed	1/2	rot	Number of feeder auger's rotations at each PRE-BURN cycle.

HEAT UP cycle is needed to slow down heating up of the burning chamber's ceramic stones in order to minimize their thermal stress and thus prolong their lifetime. HEAT-UPparameters are described in Table 16 .

Table 16 HEAT-UP parameters

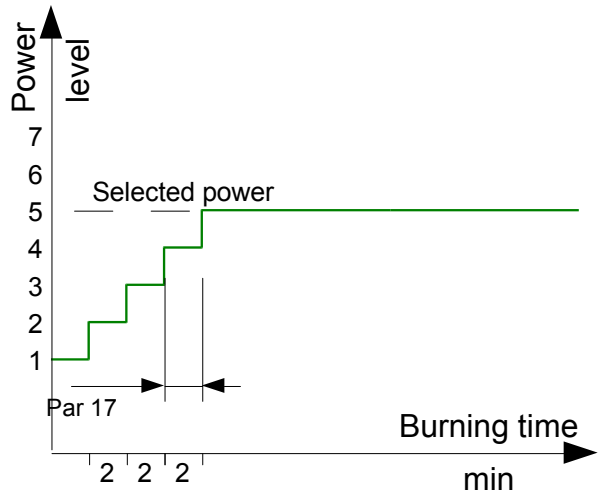
PAR No	Parameter name	Default value	Unit	Comment
PAR70	HEAT UP TIME	20	min	Initial heat up time of ceramic stones.
PAR71	HEAT UP POWER	30...70	kW	Initial heat up power of ceramic stones.
PAR72	HEAT UP TEMPERATURE	500	°C	Ceramic stone minimum temperature

When HEAT UP is in mode ON - burner stops HEAT UP cycle after heat up time set in PAR70 is exceeded. (Temperature of stones is not measured directly).
When HEAT UP is in AUTO mode - burner stops HEAT UP cycle after time set in PAR70 is exceeded or stone temperature is higher than set in PAR72. (Temperature of stones is not measured directly).

BURNING is main action status in burner's every day's operation.
Burner can operate on 11 different fixed power levels. There are 6 main power levels, which can be selected and adjusted. 5 virtual power levels (between main power levels) are for smoother operation – they can't be adjusted or selected.
For every power level, the primary fan speed is fixed in PAR1...PAR6 and secondary fan speed in PAR31...PAR36. The fan speed for virtual levels is calculated as average from previous and next main level speed. Power levels are represented in Table 17.

Table 17 Power levels

Power level	Level type	PV350	Primary fan	Secondary fan
1	**main**	**100**	**Par 1**	**Par 31**
2	virtual	120	-	-
3	**main**	**150**	**Par 2**	**Par 32**
4	virtual	170	-	-
5	**main**	**200**	**Par 3**	**Par 33**
6	virtual	220	-	-
7	**main**	**250**	**Par 4**	**Par 34**
8	virtual	270	-	-
9	**main**	**300**	**Par 5**	**Par 35**
10	virtual	320	-	-
11	**main**	**350**	**Par 6**	**Par 36**



Power level can be selected in main menu. Power level selection for burning time can be automatic or fixed on some main level. When power level is fixed, the power is slowly raised to selected level and will be there until boiler thermostat switches off.

Figure 11 Burning at fixed power

In Automatic Power mode (POWER = AUTO in main menu), the operation power is selected automatically depending on burning cycle length.

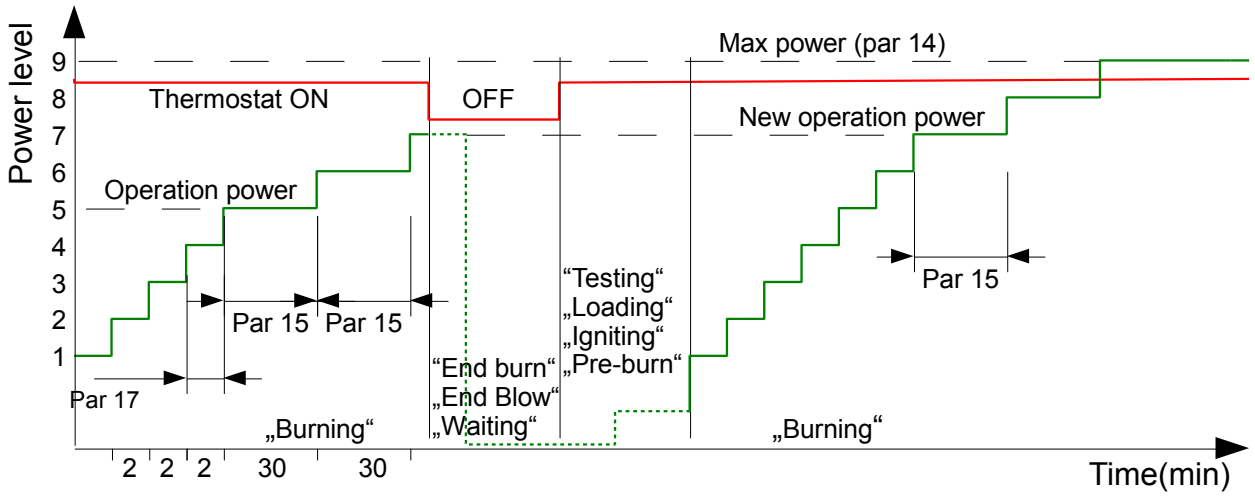


Figure 12 Burning procedure when power selection = AUTO

The purpose of **HOLD FLAME** mode is to avoid burner start-up procedures i.e TESTING, CLEANING, LOADING, IGNITING etc. every time, when burner is switched on from boiler thermostat. In HOLD FLAME mode, minimum fuel and air amount are delivered to burning chamber. HOLD FLAME mode can be switched on from burner main menu. When HOLD FLAME is set to AUTO, burner will turn the mode ON or OFF depending on WAITING time:

- If WAITING (time between END BLOW and boiler thermostat switched on) is shorter than set in PAR 11, then HOLD FLAME mode will be switched on.
- If HOLD FLAME time is longer than set in PAR12, HOLD FLAME mode is switched off.

HOLD FLAME is also used as intermediate state before CLEANING or after SLOW DOWN.

Table 18 HOLD FLAME parameters

PAR No	Parameter name	Default value	Unit	Comment
PAR10	FAN@HOLD FLAME	10	rps	Primary fan speed at HOLD FLAME
PAR39	FAN 2 MIN	7	rps	Minimum speed of secondary fan. Used at IGNITION, PREBURN, HEAT UP, HOLD FLAME and END BLOW statuses.
PAR11	HOLD FLAME ON	15	min	If two consecutive WAITING states have been shorter than 15 min, HOLD FLAME will be activated.
PAR12	HOLD FLAME OFF	60	min	Maximum time when burner holds flame.

The **END BURN** cycle helps securely to stop burning procedure in burning chamber of burner. All pellets inside the burning chamber and feeder tubes will be burnt. Amounts of pellets delivered and fan rotation

speed (power level) are same as in BURNING status. If burner goes to END BURN from other states (e. g. HOLD FLAME), the first power level is selected. Burner works in END BURN until feeder tube is empty - feeder has made as many rotations as selected in PAR26. END BURN can be used in case of some occurred errors e.g. If pellets have run out and NO PELLETS is displayed the burner stops safely normal BURNING cycle.

Table 19 END BURN FEED parameters

PAR No	Parameter name	Default value	Unit	Comment
PAR26	END BURN FEED	50..80	rot	Feeder auger rotations to clean up feeder's pipe.
-	Minimum feed	20	rot	If fewer rotations are made and boiler thermostat is switched on then burner goes back to BURNING state.

The **END BLOW** cycle is needed to burn finally all unburned pellet coals in the burning chamber. Burner will wait for flame disappearing in burning chamber. In PAR27 is fixed the end blow time, i.e. the time how long the fans continue to blow after flame's disappearing.

Table 20 END BLOW parameters

PAR No	Parameter name	Default value	Unit	Comment
PAR9	FAN@END BURN	20	rps	Fan speed at END BURN.
PAR39	FAN 2 MIN	7	rps	Minimum speed of secondary fan. Used at IGNITION, PREBURN, HEAT UP, HOLD FLAME and END BLOW statuses.
PAR27	END BLOW TIME	2	min	Time to blow air after flame is disappeared
-	Max. END BLOW time	15	min	Maximum time when flame must disappear at END BLOW.

5.5 Output power levels

Burner has 6 pre-set output power levels. For every level, the program calculates correct fuel amount what depends on fuel's calorific value and burner's internal feeder productivity. The feeder productivity for normal, light and heavy pellets can be changed from main menu. For normal pellets it is 80 grams per rotation (PAR21). Calculated amount of fuel is divided into periodic feeding cycles. In every normal cycle internal feeder makes half rotation. If the calculated time of cycle comes too short then the cycle length will doubled and fuel will loaded with full rotation of feeder. For every power level there is different pre-set fan rotation speed (PAR1..PAR6).

Burner chooses the output level between pre-set min and max powers. When burning time has been more than 30 minutes (PAR 15), next time burner takes one power level up, when burning time has been less than 30 minutes (PAR 16), next time burner takes one power level down.

5.6 Main menu and settings

To enter to main menu press OK. To move in main menu use ↓↑ buttons. To enter to menu parameter press OK. To change paramerer press ↓↑ buttons. To confirm change press OK. To go back to main menu, press ESC button. Main menu is depicted in Table 21.

Table 21 Main menu

Menu nr	Menu para-meter ENG	Description	Default settings	Options
1	STATUS->	Submenu with status info		
2	INFO->	Burner's info		
3	BURNER	Burner's turning ON/OFF	OFF	ON/OFF
4	HOLD FLAME	Hold flame allowed	OFF	ON/OFF/AUTO
5	PELLETS	Fuel quality options	NORM	NORM/LIGHT/HEAVY
6	POWER	Power level selection	AUTO	PV500: AUTO/560/480/400/320/240/160
7	BASE AIR	Fan speed change at once for all power levels	0	-2/-1/0/+1/+2/+3/+4/+5
8	LANGUAGE	Language options	ENG	*Annex 6 List of languages*
9	PARAMETERS ->	Parameters menu		*Annex 4 List of parameters*

Info screen in **STATUS** menu displays last events (burner statuses) and their duration. The duration is in form mm:ss ('m' in the middle) or hh:mm ('h' in the middle). For example "Igniting 01m25" means that the burner ignition state lasted 1minute and 25 seconds. Last row of the log shows current state. The duration of current state updates every second or minute.
INFO menu displays following main burner's indicators. See Table 22 .

Table 22 INFO menu

Screen text	Description
P= 00/480 kW	Actual and maximum power. Max power can be changed from main menu.
T=181^{0}C	T – Fire brick temperature.
F=10/13±2 14/15	10 – Primary fan's actual speed, 13 – Primary fan's set-point speed. Actual speed is controlled to match set-point speed. ±2 - Base air value. Controller tries to keep speed set-point + base air. In this case controller keeps speed 15 rps. Speed unit is rps (rotations per second). 14/15 – Same as above for secondary fan. Base air setting is same ±2
Δp=-0,2/-15Pa	Pressure value of burning chamber. -0,2 is currently measured pressure and -15 is set-point in Pa. Controller regulates flue gas fan speed to keep this pressure. Depends also on PAR60 value.

Total=10 kg	Roughly total amount of pellets burnt. It is measured by counting internal feeder rotations. Resettable by firmware upgrade
Count=12,1 kg 180/254	Roughly the amount of pellets burnt, resettable by user.
U=25V68 I=0.0A	U - DC power voltage 25V68 means 25.68V. I – Feeders and/or grate motor current
Ver=3.88 12/11/13	Firmware version and date

Menu **BURNER** enables to turn burner ON or OFF.

The main idea of **HOLD FLAME** function is to reduce permanent ON OFF cycles. This function is useful if burner's working time is much longer than stand by time. For example 1 hour of working time and 10 minutes of waiting time. In „HOLD FLAME"status the fan rotates slowly (PAR10) and small quantities of fuel are added to burner. Existence of flame is not checked. Such status lasts max one hour, after what burner ends usual cycle and stands by. If signal from boilers thermostat arrives before hour, burner goes to state BURNING. If HOLD FLAME is set to AUTO, it activates if two stand-by times have been shorter than set value in PAR11. HOLD FLAME turns off if flame has been hold more than PAR12 value.

Menu **PELLETS** enables to select between 3 pre-set fuel quality options. Depending on fuel quality the mass of fuel could differ in same amount. That's why the calorific value of same amount may differ. By default burner calculates that one rotation pushes 160 grams pellets (PAR21) to burning chamber. If pellets density is smaller i.e. they are lighter, then with one rotation less pellets will be delivered into burning chamber. Such mistake has to be compensated by choosing LIGHT from PELLETS menu. Now burner calculates that one rotation equals with 150 grams of pellets (PAR22) and makes more rotations. In general case there is no need to make change in PELLETS menu.

Menu **POWER** determines caloric productivity of burner in kilowatts. Power is calculated by reading the rotations of the feeder auger, taking into account average caloric value of 1 kg of pellets. It is possible to pre-set particular (160; 240; or else) power level value or AUTO - automatically selected value. In AUTO status burner selects necessary power level depending on time what is needed to achieve pre-set temperature. Burner changes its capacity what is determined by parameters MIN POWER (PAR13) and MAX POWER (PAR14). If burner cannot achieve pre-set temperature in certain time (PAR15) it will raise its power automatically by one level and continues rising power up to reaching maximum level (PAR14) or boiler has achieved pre-set temperature.

If boiler achieves pre-set temperature faster than set in PAR16 burner will work one power level lower in next cycle. Power will be reduced as long as burner has reached minimal power level (PAR13).

Menu **BASE AIR** increases or decreases speed of fan in all power levels by same number. It is reasonable to use base air to balance different characters of particular heating systems. For example if draught is very strong, the fan can work at lower speed and thus reduce the draught.

Menu **LANGUAGE** enables user to select between 17 languages. List of languages is in Annex 3.

Menu **PARAMETER** gives overview of burner's default and minimal maximal settings. The menu enables fine tuning of the burner what in general is not necessary. Short description of burner's parameters is given in Annex 3.

5.7 Regular maintenance

Pellet burner requires systematic maintenance**.** The maintenance period depends on the quality of the pellets and heating intensity.

The boiler must be cleaned weekly. For more information about cleaning the boiler, please see boiler's user manual.

The burner should be cleaned about two times in a heating season.

To clean the burner:

1. Turn off the burner by turning the boiler’s thermostat to 0.
2. Let the burner cool down for at least 1 hour.
3. Open the boiler's door to gain access to the burning chamber.
4. Remove the grates and clean them from any residues. Make sure that all air-holes on the grates are clean.
5. Remove the bottom panel to gain access under the grate movers to clean the ash from the burning chamber.
6. Place back the bottom panel.
7. Place back the grates. Make sure the stopper of grate is touching the burning camber from inside. Misaligned base plate will interfere the air flow and reduce burning efficiency
8. Close the boiler's door to finish the maintenance and turn the thermostat to desired temperature.

The connection between the boiler and chimney must be completely airtight. There mustn't be any extra draught in the smoke draft of the boiler. All cleaning and maintenance openings must be closed with covers.

6 Problems and solutions

Table 23 Problems and solutions

Message on screen	Reason and solution
BATTERY LOW	• Battery voltage is less than 24V with load (working feeder motor). ○When there was blackout then just wait when battery recharges itself. ○Replace battery
IGN.ERROR	• No flame detected at ignition time. ○Igniter is out of order or fuse is blown. Usually fuse blows when igniter is broken or its body is in short circuit. Replace fuse or igniter ○Flame sensor is dirty or smelt. Clean or replace sensor if needed. ○Amount of pellets for igniting is too small. If error is frequent, increase amount of pellets PAR24.
STOPPED	• Burner is turned OFF from menu. ○To turn burner on hold OK button down 3 seconds or set in BURNER menu OFF to ON.

LEVEL ERROR	• Feeder auger doesn't rotate. ○Remove plastic hose and check is there any foreign object or very tall pellet jammed the feeder auger. Remove obstacle. • A fuel level sensor is dirty or melt. Clean or replace sensor if needed. ○Poor draught, dirty sensor. Check sensor, clean if needed. Improve draught.
NO PELLETS	• Max loading time is reached, but level sensor hasn't detected enough fuel in feeder or in burning state during 4 minutes no pellets detected. ○No pellets in container. Check existence of pellets, refill container. ○External auger is broken. Check fuse and connection with burner. Replace fuse or auger. ○Fuel level sensor is broken or short. In this case transparent tube has to be filled with pellets. Replace sensor. ○Too much sawdust in container and external auger can't reach the pellets. Remove sawdust.
NO FLAME	• Flame is disappeared at pre burning time or at burning time. ○Fuel level sensor is dirty or broken. Check sensor, clean or replace if needed. ○Flame sensor is dirty or smelt. Clean or replace sensor.
SRP	• Appears in screen for some seconds when turning on the burner. ○If message doesn't disappear push any button on the front panel.
FEEDER ER-ROR	• Feeder auger has not made any rotations in 8 seconds at its running time. ○Feeder auger motor's rotation sensor is too far from magnet. Check sensor's placement. It has to be located maximally on magnet and not far than 2..3 mm. Sensor has not to touch rotating parts of motor. ○Feeder motor's reducer may be broken (if motor makes noise). Replace both. • Feeder auger motor current has reached its limit and over-current protection applied. ○Feeder auger may be blocked or jammed by foreign object. Remove obstacle.
FAN ERROR	• Fan has not reached enough speed at testing time. Fan motor's rotation sensor is too far from magnet. Check sensor's placement. It has to be located maximally on magnet and not far than 2..3 mm. Sensor has not to touch rotating parts of motor. ○Fan doesn't rotate. Bearings too dusty or fuse blown. Clean bearings or replace fan. ○Fuse has blown. Replace fuse
NO POWER	• The mains supply doesn't reach controller. ○Back burning and safety thermostat have turned mains off. Possible reasons are poor draught, too much ash in burner or in boiler or poor burning procedure. Improve draught, remove ash, use only quality pellets. Poor burning may be caused by big amount pellets feed (heavy pellets) or poor stream of the air. Change PAR23 "heavier". ○General blackout. Wait for end. Restart burner.
OVERHEAT	• Burner internal temperature reached over set-point as fixed in setup menu. • Possibly back-burning is happened. ○Bad connection of temperature sensor. Check and improve if needed. ○Insufficient entrance of fresh air into the boiler room. Draught to wrong direction. Ensure availability of fresh air and improve draught.

GRATE ERROR	Over- current of grate movers motor has exceeded value set in PAR47 and over- current protection has applied. Ash removing grate has jammed before reaching extreme point. Remove reason. • Motors power screw got dirty and stops rotation. Clean the screw.
Screen empty, backlights on	• Controller error or screen error. o Replace respective component. • The contrast of screen is poor. Contrast can be adjusted with small screwdriver by turning the resistor CONTR on down edge of controller. In one extreme the screen displays nothing and in other extreme screen is filled with black rectangles.
Screen empty no backlights	• No mains supply. o Fuse F5 is blown (only for controller SBB ver3.2). Replace fuse.

Annex 1 – Burner status change logic

Table 24 Burner change logic

Status	Next Status	Change conditions
WAITING	TESTING	Boiler's thermostat switches on.
TESTING	LOADING	All tests are passed successfully.
	BATTERY ERROR	Battery voltage is less than 24V in burdened status.
	FAN ERROR	Fan does not reach 40 rps at PRE-BURN.
	LEVEL ERROR	The level sensor recognizes pellets in the feeder.
LOADING	IGNITING	Feeder makes loading rotations 40 rot/min (PAR24).
	NO PELLETS	Maximum loading time (5 min normal or 20 min initial) is reached.
	END BURN	Flame detected and unknown start conditions. LOADING restarts.
LOADING 2	IGNITING	Previous state was ignition and feeder made 3 rotations.
	PRE-BURN	Previous state was hold flame and feeder made 3 rotations.
IGNITING	PRE-BURN	Flame recognized by flame sensor.
	LOADING 2	Max ignition time 255 sec is reached and load 2 is not done.
	IGN.ERROR	Max ignition time 255 sec is reached and load 2 is done.
PRE-BURN	BURNING	3 pre-burn cycles each 40 sec are done and continuous flame is recog-nized more than 10 seconds.
	LOADING 2	Pre-burn cycles are done and flame is NOT recognized and load 2 is NOT done.

	NO FLAME	Pre-burn cycles are done and flame is NOT recognized and load 2 is done.
HEAT UP	BURNING	Pellets are burning, power is added step by step in order to slow down heating up of the burning chamber's ceramic stones in order to minimize their thermal stress and thus prolong their lifetime.
BURNING	END BURN	Boiler's thermostat is NOT switched on. (HOLD FLAME is NOT allowed).
	HOLD FLAME	Boiler's thermostat is NOT switched on. (HOLD FLAME is in AUTO mode).
	END BURN	Maximum continuous burning time (4 hours) is reached.
	END BURN -> END BLOW ->LEVEL ERROR	Fuel level is continuously detected at time of 8 feeder auger rotations.
	END BURN -> END BLOW ->NO PELLETS	Fuel level is not detected in 4 min.
	NO FLAME	Flame is not detected more than 2 minutes.
HOLD FLAME	LOADING 2	Boiler thermostat is switched on.
	END BURN	Max KEEP FLAME (1 hour) is reached.
END BURN	END BLOW	Flame is not recognised in 1 min and boiler's thermostat is switched off.
	BURNING	Boiler thermostat is switched on, feeder auger has made less than 8 rotations and previous state was BURNING.
END BLOW	WAITING	Burning end. Feeder auger has made 15 + 10 rot and blowing time 60 sec is reached
	STOPPED	Flame is not recognised in 1 minute and burner is not switched on.
	NO FLAME	In Burning status flame misses more than 1 minute.
	LEVEL ERROR	In Burning status level of fuel in feeder's inlet doesn't decrease.
	NO PELLETS	No pellets recognised in feeder's inlet.
NO POWER	WAITING	Power exists and boiler's thermostat is switched off.
	STOPPED	Power exists and burner is not switched on.
	BURNING	If status before No Power was Burning and No Power didn't last more than 5 min.

7 Annex 2 Electrical diagramm

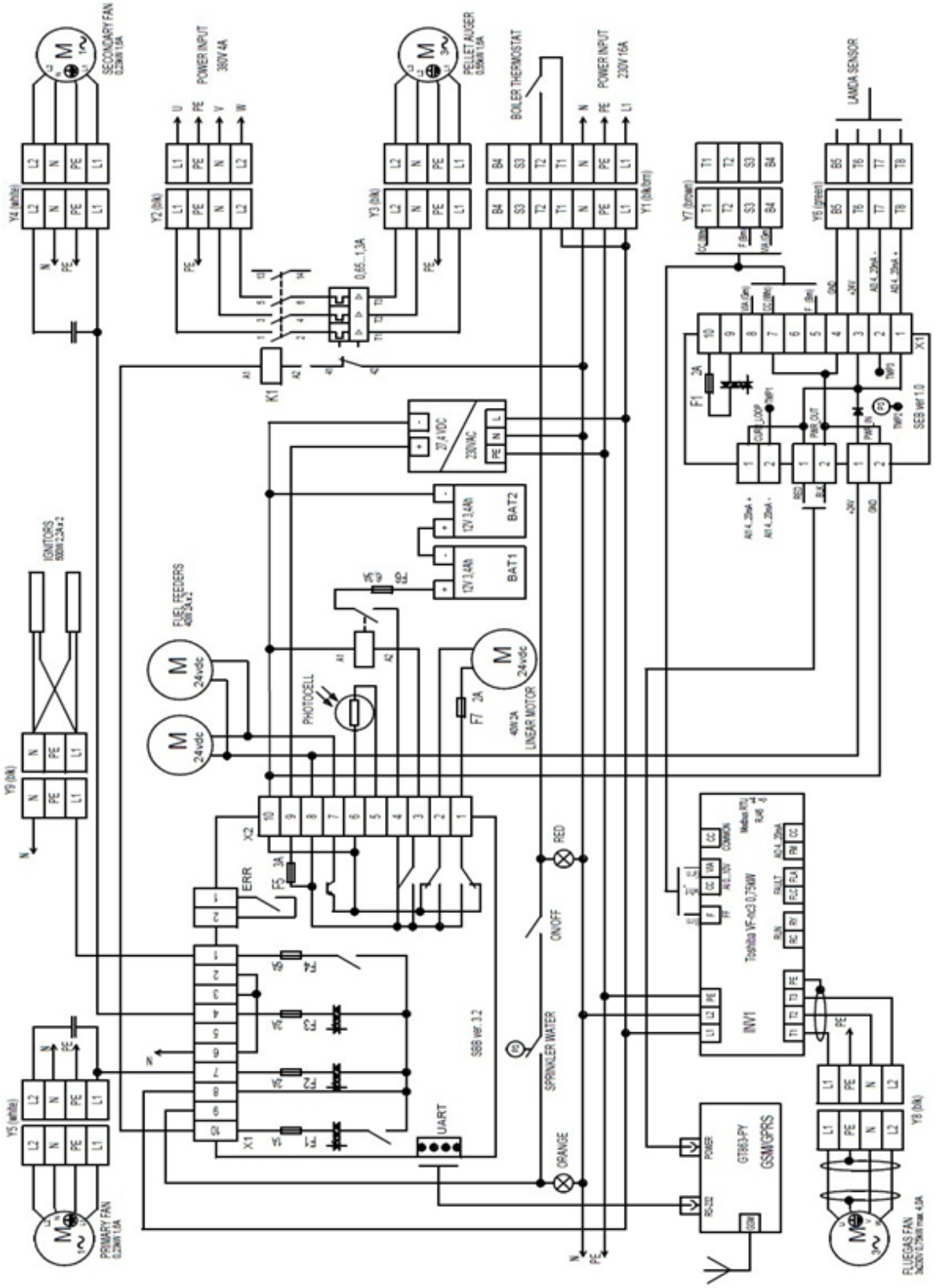


Figure 13 Electrical diagram

8 Annex 3 Controller board

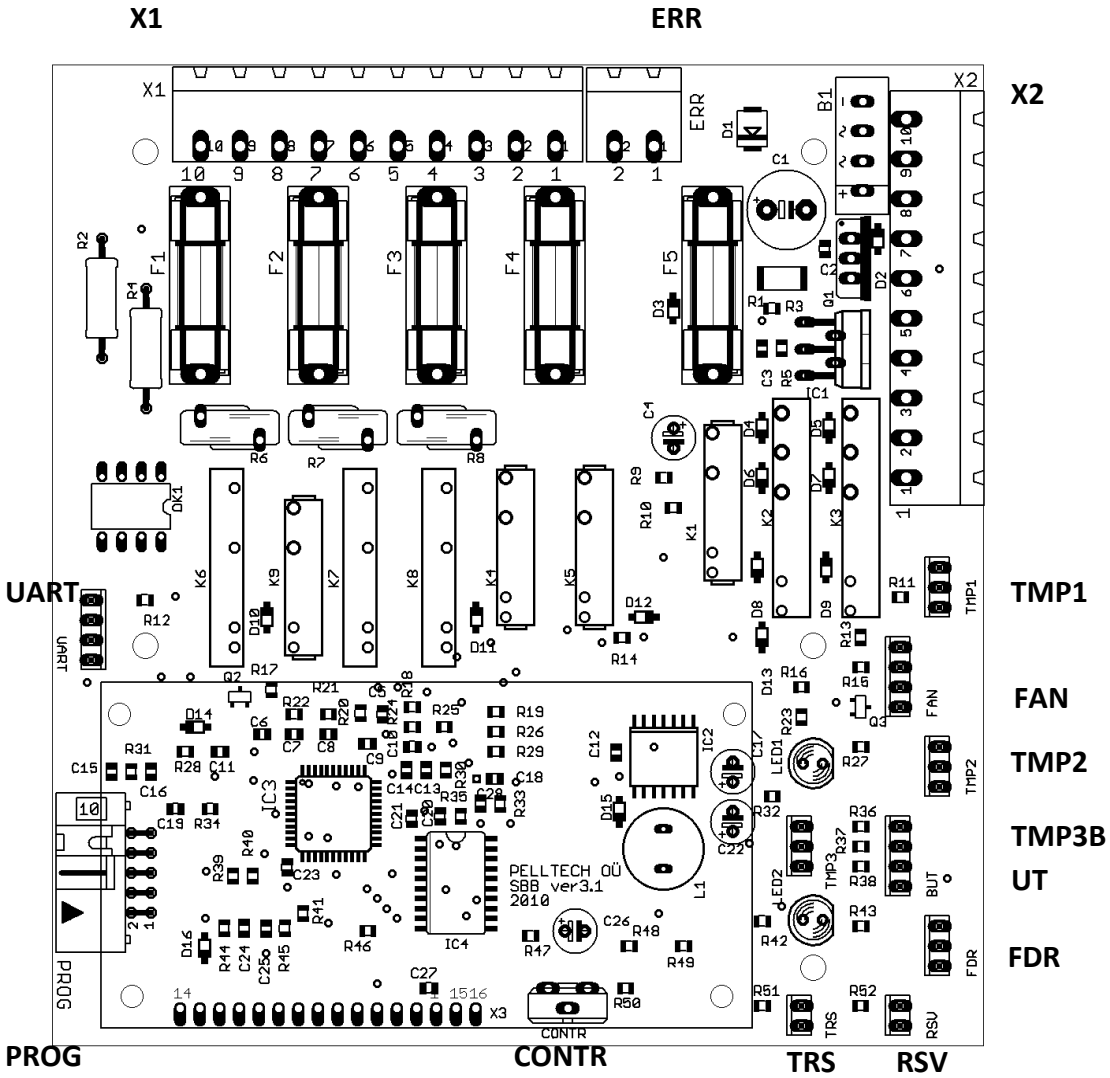


Figure 14 Controller board

X1 – Connector terminal
ERR – Error output
X2 – Connector terminal
TMP1 – Feeder auger temperature sensor
FAN – Fans rotation sensor
TMP2 – Connected to TMP3 on ext. board
TMP3 – Connected to TMP3 on ext. board
BUT – Control button connector
FDR – Feeder augers control
RSV – Fuel level sensor's signal receiver (White marked)
TRS – Fuel level sensor's signal transmitter (Black marked)
CONTR – LCD contrast adjustments
PROG – Programming outlet
UART – RS232 Modem connector

Table 25 Controller board connector terminals X1 and X2

	Description	X2	Description
1	Igniter	1	Ash removal -
2	Igniter	2	Ash removal +
3	N	3	Battery positive terminal
4	Flue gas fan	4	Battery negative terminal
5	Mains transformer	5	Flame sensor
6	Mains transformer	6	Flame sensor
7	Fan	7	Feed screw - (black)
8	L	8	Feed screw + (red)
9	Thermostat	9	Mains transformer
10	External auger	10	Mains transformer

Table 26 Fuses

	Rating	Function
F1	0.5A quick	External auger
F2	0.5A quick	Fan
F3	0.5A quick	Flue gas fan
F4	3A quick	Igniter
F5	2A quick	Controller and feeder motor

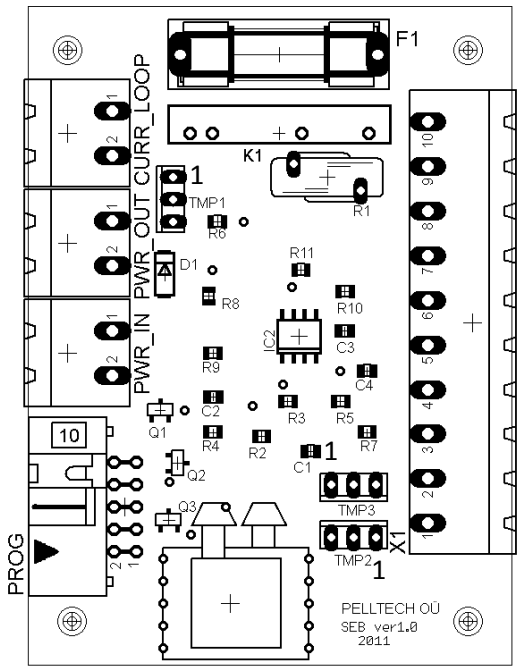


Figure 15 Extension board

Table 27 Extension board connector terminals X1 and X2

X1	Description
1	Lambda +
2	Lambda -
3	+27.2V
4	Ground
5	Inverter F
6	-
7	Inverter CC
8	Inverter VIA
9	-
10	-

9 Annex 4 Table of parameters

				PV500		
PAR No	PAR Name	Description	Unit	Fefault	Min	Max
PAR1	FAN@160	Fan speed at 1. power level	rps	28	15	50
PAR2	FAN@240	Fan speed at 2. power level	rps	32	15	50
PAR3	FAN@320	Fan speed at 3. power level	rps	34	15	50
PAR4	FAN@400	Fan speed at 4. power level	rps	37	15	50
PAR5	FAN@480	Fan speed at 5. power level	rps	40	15	50
PAR6	FAN@560	Fan speed at 6. power level	rps	42	15	50
PAR7	FAN START	Fan speed at TESTING	%	190	80	240
PAR8	FAN @IGNITING	Fan speed at IGNITING and PRE-BURN	rps	25	20	35
PAR9	FAN @END BURN	Fan speed at END BURN	rps	20	10	40
PAR10	FAN @HOLD FLAME	Fan speed at HOLD FLAME	rps	10	7	14
PAR11	HOLD FLAME ON	HOLD FLAME function is activated if two consecutive WAITING states have been shorter than set in this parameter. Applies in AUTO status only	min	15	5	30
PAR12	HOLD FLAME OFF	Max time when burner holds flame. HOLD FLAME function has to be set to AUTO.	min	60	30	90
PAR13	MIN POWER	Minimum power level up to what burner decreases output power. Applies in AUTO status only	kW	160	160	480
PAR14	MAX POWER	Maximum power level up to what burner increasesoutput power. Applies in AUTO status only	kW	480	160	560
PAR15	POWER UP	Timeframe to burner to increase power to one level up if BURNING state lasts longer than set with this parameter. Applies in AUTO status only	min	30	2	120
PAR16	POWER DOWN	Timeframe to burner to decrease power to one level down if BURNING lasts less than set with this parameter. Applies in AUTO status only	min	30	15	60
PAR17	UP CYCLE	Pace of increasing targeted power level party-steps	min	2	0	3
PAR18	DOWN CYCLE	Pace of decreasing targeted power level party-steps	min	2	1	3
PAR21	PELLETS NORMAL	Determines how many grams of pellets feeder auger transports to burning chamber with one full rotation when PELLET NORM ie normal weight pellets are selected	g/rot	160	120	200
PAR22	PELLETS LIGHT	Determines how many grams of pellets feeder auger transports to burning chamber with one full rotation when PELLET LIGHT ie lighter than normal weight pellets are selected	g/rot	150	120	200

PAR23	PELLETS HEAVY	Determines how many grams of pellets feeder auger transports to burning chamber with one full rotation when PELLET HEAVY ie heavier than normal weight pellets are selected	g/rot	170	120	200
PAR24	LOADING FEED	Number of feeder auger rotations in LOADING state	rot	40	20	80
PAR25	LOADING 2 FEED	Number of feeder auger rotations in LOADING2 state	rot	3	1	8
PAR26	END BURN FEED	Number of feeder auger rotations in END BURN state	rot	70	20	120
PAR27	END BLOW TIME	Fan's END BLOW time after flame is disappeared	sec	60	30	250
PAR30	FAN 2	Secondary fan control ON/OFF (not used in PV50b)	1/2	3	3	3
PAR31	FAN@160	Secondary fan speed at 1. power level	rps	20	5	80
PAR32	FAN@240	Secondary fan speed at 2. power level	rps	25	5	80
PAR33	FAN@320	Secondary fan speed at 3. power level	rps	32	5	80
PAR34	FAN@400	Secondary fan speed at 4. power level	rps	39	5	80
PAR35	FAN@480	Secondary fan speed at 5. power level	rps	41	5	80
PAR36	FAN@560	Secondary fan speed at 6. power level	rps	43	5	80
PAR38	FAN 2 BASE	Changing amount of secondary fan base air with flue gas fan speed setting in all power levels	%	100	65	140
PAR39	FAN 2 MIN	Secondary fan minimal speed	rps	7	5	20
PAR40	PHOTOCELL LEVEL	Flame sensor sensitivity. Higher number means that flame is recognized when less light	%	84	50	100
PAR41	PRE-BURN TIME	Length of one PRE-BURN cycle state	sec	40	30	80
PAR42	PRE-BURN CYCLE	Number of PRE-BURN cycles. Total length of PRE-BURN cycles is length of one cycle times number of cycles	X	3	1	4
PAR46	FEED CURRENT	Preset feeder auger motors current. Overcurrent protection threshold	A	5	1	9,9
PAR47	GRATES CURRENT	Grate motor overcurrent protection threshold	A	2	0,2	3
PAR48	CLEANING CYCLE	Pre-set time between two cleaning cycles (0=CLEANING OFF)	min	60	0	250
PAR50	RELAY ERROR	ERR output function selection	1/2	1	1	5
PAR52	SMS COUNT	Selecting number of phones receiving alert SMS	X	3	0	5
PAR53	TEMP.TYPE	Determines temperature sensor type plugged in TMP1 connector	-	0	0	7
PAR54	TEMP.LEVEL	Set point value for temperature sensor plugged to TMP1	°C	70	30	240
PAR55	TEMP.HYST	PAR54 maximum set point hysteresis	°C	5	2	10
PAR58	BASE FREQUENCY	Grid frequency	Hz	50	45	63
PAR60	FLUE GAS TYPE	Flue gas fan ON-OFF 0=ON; 2=OFF	-	1	0	2
PAR61	DRAFT SET	Flue gas fan pre-set set point	-Pa	8	0	250
PAR62	DRAFT ERROR	Flue gas fan error level	+Pa	10	0	20
PAR63	DRAFT BASE	Draught sensor calibration value	%	110	50	150

PAR66	OXYGEN TYPE	Type of oxygene sensor: 0 no sensor 1 4..25mA=0..25% 2 4..20mA=0..20%	-	0	0	2
PAR67	OXYGEN SET	Oxygen level setpoint	%	6	4	12
PAR70	HEAT UP TIME	Initial heat up time for burners with ceramic burning chamber	min	20	0	60
PAR71	HEAT UP POWER	Initial heat up power for burners with ceramic burning chamber	kW	4	1	10
PAR99	BURNER TYPE	Selecting model of burner. Software of wrongly selected model works incorrectly	-	500	20a	1M

10 Annex 5 List of statuses

Status	External auger	Feeder auger	Fan	Ignitor
WAITING	-	½ rot / 127s	-	-
TESTING	-	2 rot	Maximum /10 sec	-
LOADING	By level	21* rot	-	30...60 sec
LOADING 2	-	3* rot	rps_ign	-
IGNITION	-	-	rps_ign	30s on/20s off
PREBURN	-	-	rps_ign	-
BURNING	By level	By power	By power	-
HOLD FLAME	By level	½ rot / 127s	rps_hold	-
END BURN	-	By power	By power	-
END BLOW	-	-	rps_end	-
STOPPED	-	½ rot / 127s	-	-
NO PELLETS	-	½ rot / 127s	-	-
NO FLAME	-	½ rot / 127s	-	-
OVERHEAT	-	½ rot / 127s	-	-
IGNITION ERROR	-	½ rot / 127s	-	-
LEVEL ERROR	-	½ rot / 127s	-	-
FEEDER ERROR	-	½ rot / 127s	-	-
FAN ERROR	-	½ rot / 127s	-	-
BATTERY LOW	-	½ rot / 127s	-	-
NO POWER	-	½ rot / 127s	-	-

11 Annex 6 List of languages

	Language
ENG	English
ESP	Spanish
EST	Estonian
FIN	Finnish
FRA	France
GER	German
GRE	Greece
HRV	Croatian
LTU	Lithuanian
LVA	Latvian
NLD	Dutch
PRT	Portuguese
RUS	Russian
SLO	Slovenian
SRB	Serbian
SVK	Slovakian
SWE	Swedish

Warranty

Warranty objects in this context are pellet burner PV500 and supplied auger.
Producer gives 2 years warranty from the date of sale for the PV500 burner and supplied auger.

Exception is ignition element (igniter), for this item warranty is 1 (one) year.

Warranty is valid when user had not made changes in the construction and setup of the burner.

Warranty does not cover defects caused by an accident, misuse, abuse, improper installation or operation, lack of reasonable care, unauthorized medication, loss of parts, tampering, attempted repair by a not authorized person, mains errors or using poor quality fuel.

Warranty is valid only if the bottom half of the warranty ticket is filled in and sent or brought to the office of Pelltech OÜ Sära tee 3, Peetri, Rae vald, 75312 Harjumaa ESTONIA

Ph.. + 372 677 5277
www.pelltech.ee
info@pelltech.ee

Warranty ticket

Burners model	**PV500**
Product number	……
Sales date	……
Installation/commissioning date	……
Owners contacts	Installers name and signature
Name ……	……
Phone nr ……	……
City/village ……	
Street/ House ……	

……Cut here!……

Warranty ticket

Burners model	**PV500**
Product number	……
Sales date	……
Installation/commissioning date	……
Owners contacts	Installers name and signature
Name ……	……
Phone nr ……	……
City/village ……	
Street/ House ……	

Warranty is valid only if the bottom half of the warranty ticket is filled in and sent or brought to the office of Pelltech OÜ Sära tee 3, Peetri, Rae vald, 75312 Harjumaa ESTONIA

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